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THE LITHARGE TEST FOR FUEL.

ONE of the most interesting discussions at the recent Brighton meeting of the I.M.E.A. was that on the purchase of fuel, with which fuel testing is intimately connected.

That fuel should be purchased on some defined basis connected with the cost of generating electricity is obvious —in these days the "cheap" unit leaves no alternative. But whether extremely accurate calorific determinations of fuel value are a necessity, whether it is possible in practice to obtain uniform accuracy in testing, and even if obtained, whether the practical station test does not in any case form a much safer and more reliable guide to the fuel purchaser, must be left to the experience of the engineer.

For the latter, there are other important factors to consider, such as the cost of carriage and the type of furnace in use, which influence the class of fuel adopted. If a rough and ready calorific test is required, there seems to be no reason why the Berthier litharge method used at Lot's Road power station, to which attention was drawn in the M.E.A. discussion at Brighton (see page 118), should not be more generally adopted.

The method of testing fuel by means of litharge resolves itself into a change of base of chemical compounds. Just as, in thermit welding, metallic iron is produced from iron oxide by the greater affinity of oxygen for aluminium than for iron, so in the litharge test metallic lead is produced when lead oxide or litharge is heated with carbon, the latter robbing the lead oxide of its oxygen.

Lead forms four oxides—the little-known black oxide Pb_2O, PbO, PbO_2 and Pb_3O_4. The red oxide, or litharge, is the protoxide or PbO. The atomic weight of lead is 207; that of oxygen, 16; that of carbon, 12.

So long as sufficient litharge is used, the actual weight employed is not of moment, for the duty of the litharge is to supply oxygen to a small weight of fuel which is made up of carbon, hydrogen and certain oxides, of which one may be that of hydrogen.

With an ample supply of oxygen, carbon will always oxidise to CO_2. Let it be assumed that a weight of 20 grains of fuel is employed. Each grain of carbon will absorb 2·667 grains of oxygen. Each grain of oxygen absorbed will represent 207/16 = 12·94 grains of lead. Therefore, each grain of carbon oxidised will represent 12·94 × 2·667 = 34·5 grains of metallic lead.

This metallic lead appears as a button in the closed crucible in which the reaction must be carried out. Thus, if the button of lead is found to weigh 345 grains, there must have been 10 grains of carbon converted into dioxide. But this litharge test does not tell how much o the oxygen absorption is due to the uncombined hydrogen.

It does tell, however, what proportion of a sample of fuel is combustible. Again, it does not tell the exact calorific power of the fuel, for this will vary with the composition of the hydrocarbons in the coal.

The litharge test is based on Welter's formula, and this supposes, but inaccurately, that the heat of combustion is proportional to the consumption of oxygen.

The Welter formula for the heat of combustion (N) is—

$$N = 26{,}880 \left(\frac{C}{3} + H\right),$$

where C and H are the weights of carbon and of hydrogen in a kilogramme of the fuel. Thus, it is necessary to know how much of C and of H are present in a sample, and the method ceases to be a rapid one, though it may be used for finding the ratios of combustible in different samples. But these ratios are not necessarily correct indications of the calorific value, for Scheurer-Kestner showed that not only did the formula above give inaccurate results, but it might even reverse the relative values of two fuels. He mentions a case where two samples tested by calorimeter gave 8,813 and 8,750 cals. respectively, whereas the litharge formula gave 7,547 and 7,977, results not merely under value but reversed. Thus the litharge test can only be used for very crude results.

At the same time let it not be forgotten that the coal with the highest absolute calorific value is not of necessity the best coal in a particular furnace. It may clinker badly, or may burn into holes on the grate and admit too much useless air.

But if coal is to be only approximately tested, not even the litharge test need be employed; let 1 oz. of coal be weighed and then powdered and dried thoroughly. Weigh again; the difference is moisture. Burn gently away to ash; what disappears by burning is approximately combustible. This method ignores that there may be oxygen and combined hydrogen in the proportions to form water and yet that drying will not volatilise it.

Coal is too complex a substance to be accurately treated by any rough method. The accurate method by the Berthelot-Mahler bomb is too delicate for the ordinary man to use, for it involves too many corrections. Quite probably the litharge test will give fair comparative values as between coals of a given district, but not as between, say, Lancashire and Durham, or Yorkshire and Dean Forest.

In place of litharge, white lead or $PbCO_3$ has been employed. Here metallic lead is formed, and CO_2 is driven off with the rest of the CO_2 formed by the one freed volume of oxygen.

Berthier recommended the Welter formula and litharge method, but his own results did not show that the method was other than an approximation.

Brighton Pioneering.

In the Presidential Address recently delivered by Mr. J. Christie, engineer and manager of the Corporation Electricity Department, at Brighton,* many interesting facts connected with the progress of electric lighting in that town are given; but a correspondent reminds us that Mr. Christie has omitted to refer to much earlier pioneering work, both in connection with electric lighting and traction, which should not be overlooked in dealing with the history of the industry.

It was due to private enterprise that the first practical scheme of electricity supply for towns was carried out.

Mr. Christie alludes to the installation of six arcs in Madeira Road, Brighton, in 1891, as being regarded as one of the wonders of the age; but he ignores the far more important and interesting undertaking carried out by the South-Eastern (Brush) Electric Light and Power Co., Ltd., at Colchester, *seven years before*, viz., in 1884. The system was that known as the B.T.K., the object being to supply electricity to houses as gas was supplied, the current being generated at a central station and distributed to the residents of the town from storage batteries.

After supplying numerous houses, shops, hotels, &c., for about twelve months, a large company was invited to inspect the system, and among others who attended were the *Mayor of Brighton* (Dr. A. H. Cox), several representatives of the City of London Commissioners of Sewers, the Mayors of Colchester and Dudley, besides gentlemen from Eastbourne, Hastings, Wolverhampton, and many other places. The Duke of Sutherland, Sir Wm. Preece, and many others interested, from all parts of the country visited what was really the pioneer town lighting in this country, and the only works carried out under powers granted under the Electric Lighting Act of 1882.

The engineer and inventor of the system was the late Mr. Frank King, who subsequently became connected with the E.P.S. Co. and patented improvements in their batteries.

The general manager of the South-Eastern (Brush) Electric Light and Power Co., who organised the Colchester undertaking, was Mr. George Offor, who is still actively engaged in connection with the electricity supply industry.

Mr. Christie claims that Brighton was the starting place for the first electric railway, the invention of his enterprising townsman, Mr. Magnus Volk; this little line was started in 1883, and is still among the attractions of Brighton; but in connection with electric traction, earlier work should not be overlooked. The first electric railway in England was that which was constructed by the International Electric Railway Co., and ran at the Crystal Palace, at Sydenham, in 1881, the inventor being Mr. Henry Binks, among whose employés was one John Burns, now President of the Local Government Board.

The history of the Brighton electricity undertaking is of great interest, marking the progress of the business in a purely residential town, under the able management of an enterprising engineer.

Brighton is an exceptionally favourable town for an electric supply undertaking: a wealthy residential community, magnificent hotels and boarding houses, numerous places of amusement—in fact, a vast combination of an all-the-year-round pleasure resort with an attractive residential district for Londoners by the sea.

With respect to the important matter of how to get business, Mr. Christie appears to rely upon friendly co-operation with the wiring and fitting firms, rather than upon pushing sales by means of direct application to possible customers, and he appears to be in hearty accord with the Electricity Supply Publicity Committee for printed matter for canvassing purposes.

Upon this essential branch of the commercial management of the business of an electric supply undertaking we may refer Mr. Christie to our article upon "The Art of Canvassing" (May 26th, 1911), especially to the advocacy of *local pamphlets*, with testimonials from consumers, who thus become the most efficient canvassers. The public will believe what their disinterested neighbours tell them, while they receive *cum grano*, or with indifference, the statements of those directly interested in obtaining their custom. Mr. Christie's claim that the supply authority should have the power to sell and hire out motors, &c., applies, of course, only to public bodies trading at the risk of the ratepayers, private companies being at liberty to adopt all such means of facilitating business. This is one of the difficulties of municipal trading.

* ELECTRICAL REVIEW, June 30th, 1911, page 1027.

The Diesel Engine and the I.M.E.A.

We do not suppose that the missionaries of the internal combustion engine who listened to the discussion on Messrs. Howard and Carr's papers at the Municipal Electrical Convention were seriously disturbed thereby. Opportunities for using large gas engines in connection with municipal electrical supply are rare, and not such as allow of favourable comparison with large gas-engine installations in private works; moreover, the average station engineer is justifiably in love with the steam turbine, and though he may admire the modern gas engine, his admiration does not extend to chemical manufacturing. On the other hand, the

large Diesel engine exists principally on paper, although its day is fast approaching. Mr. Howard mentioned that two horizontal engines, each of 1,600 B.H.P., are installed at Halle; these are of the twin-tandem double-acting four-cycle type. The Nuremberg Co. have in hand a 1,000-H.P. double-acting two-cycle engine, one of a pair for a twin screw cargo steamer, and Messrs. Sulzer are building two 1,500-H.P. engines for a similar purpose. In this country Messrs. Richardsons, Westgarth have a 1,000-H.P. marine type engine in hand.

The German Admiralty is supposed to be building two six-cylinder engines of 6,000 H.P., or 1,000 H.P. per cylinder, and higher cylinder powers have been talked of. Evidently Mr. Howard's proposed 10,000-KW. Diesel plant (in seven 1,450-KW. sets), which he compared with the Brighton turbine plant, is within the range of possibility.

Reverting to the discussion which took place at Portsmouth on Mr. Howard's estimates, while we have no wish to detract from the excellent results obtained with turbine plant, it seems rather unsportsmanlike to dismiss his comparison on the ground that lower costs are being obtained with other turbine stations situated almost next door to the coal pit.

The Brighton works were taken to illustrate the case of a large steam-driven station, and are a fair example of an all-turbine plant running on sea-borne coal (costing 13s. per ton), and such as an oil fuel plant might reasonably be expected to compete with, if competition were possible.

In deference to the turbine man's ideal, the capital charges on the steam plant might be decreased to £13 per KW., or, say, ·24d. per unit generated, making with ·58d., the actual works costs, a total of ·82d. per unit generated for a turbine plant under Brighton conditions.

Turning to Mr. Howard's figures for the Diesel plant, they seem scarcely justified if the costs published by him for five small stations are any guide. The average works costs of the latter per unit generated amount to ·49d., with fuel averaging 51s. per ton, as against an estimated ·218d., with fuel at 37s. per ton.

Admitting the possibilities of a big output, for the sake of argument, it would be safer to double his figures, giving ·43d. per unit, and if we accept his estimated capital costs, a total of ·69d. per unit generated results. On this basis there would be a saving of ·13d. per unit generated, or over £5,000 a year, by the use of Diesel plant.

We quite recognise, of course, that with more efficient steam plant this margin would probably disappear, and there is, for instance, a large margin between the $3\frac{3}{4}$ lb. of coal per unit sold at Sunderland and the $5\frac{1}{4}$ lb. required at Brighton, with a practically similar load factor; on the other hand, one can only surmise that a saving in wages should result from the use of the Diesel engine instead of steam plant, which is not apparent in the figures we have taken.

The Salt Test for Priming.

THE salt test for steam dryness seems to be much on a par with the litharge test for coal in regard to its uncertainty. In this test a certain quantity of common salt is pumped into a boiler, and is, perhaps quite properly, assumed to produce an equal degree of salinity throughout the whole body of the water in the boiler. There is very little doubt indeed that in a boiler with fair circulation such will be the case. It will almost certainly be the case throughout the upper few inches of the water in a boiler of the shell type, though, unless the circulation is good, the water at the bottom of the boiler will differ. The moisture in steam is, for the purposes of the salt test, assumed to arise entirely from priming. This, to begin with, is a somewhat doubtful assumption. The priming is assumed to consist of the average water in the boiler carried up in the steam. Then, if the steam be condensed, the resulting water will contain the salt which has risen with the priming. If this condensed steam were then found to contain one-tenth of a grain of salt per gallon, and a sample of the boiler water drawn from the water gauge cock were found to contain two grains per gallon, the assumption would be that the ratio of 1 : 20 thus found represented the ratio of priming, the steam being 5 per cent. wet. In this test there is thus first the doubtful assumption that the moisture found in the steam arises entirely from priming, and not at all from loss of heat through the boiler crown, or through the stop-valve body, or through the steam pipe, Then it may be doubted if the priming is not in large part scum with, perhaps, more salt in it than in the body of the water; and the sample of comparison drawn from a gauge cock may also be wrong, for in the very moment of drawing out of a boiler under pressure a considerable proportion must pass off as non-saliferous steam as soon as it escapes to the lower external pressure of the atmosphere. There appear to be too many doubts and assumptions already for any reliance to be placed on such a test. Finally, there still remains the fact that no man has yet had wit enough to devise any method of taking a truly representative sample of steam out of a pipe of flowing steam. Nobody knows how the steam and water comport themselves in a pipe, and nobody can fix pipes and nozzles that will abstract true samples that can be positively or even with good reason declared to be true. This uncertainty has condemned all calorimeter tests of steam dryness, and it would be fatal to the salt test were this not already rendered valueless by other doubtful assumptions.

The Telephone Transfer.

BOTH the Post Office Department and the National Telephone Co. are to be congratulated upon the rational and business-like compromise which has been arrived at, as the outcome of the recent contests before the Railway and Canal Commissioners. In the course of the last arbitration the Postmaster-General recognised that his position of objection to telephone cables carried along electric railways was wholly untenable in the face of the overwhelming evidence of engineering experts of the first rank to the contrary, and by his surrender on this point the great advantage to the telephone system of the use of these valuable routes was retained. The final decision to allow the whole of the plant of the company to be placed upon the inventory is one which appears to meet the demands of equity, and to be in accordance with the views of the experts who gave evidence before the Commissioners. The testimony of Mr. Hayes, one of the most eminent authorities on telephone practice, was especially worthy of notice; he regarded the scrapping of existing telephone equipments, in good working order, as little short of a crime, and pointed out that in the United States the supply of apparatus from superseded exchanges in the large cities was insufficient for the smaller centres, so that new local-battery equipment has actually to be manufactured for that purpose in large quantities at the present day! Undoubtedly, as the value of all the plant will have to be appraised on a commercial basis, with appeal, if necessary, to the Commissioners, the Post Office will secure the older apparatus at bargain prices; so much the better for the service in the future. There is no indignity in using second-hand plant, and the capital outlay will be reduced.

The Postmaster-General and the employés of the National Telephone Co. are also to be congratulated upon the final settlement of their differences, which, we hope, will make for the efficient working of the system under the Post Office. We only hope that the excellent proposals of the Postmaster-General as regards the future administration of the service will be duly carried out, and that there will be an end of the telephone muddle which has perplexed the country for the past decade.

THE CONFERENCE ON THE EDUCATION AND TRAINING OF ENGINEERS.

(*Continued from page* 47.)

AT the second day's joint meeting of Sections II and III, the chairman, DR. W. C. UNWIN, F.R.S., introduced the subject of the Conference, remarking that it was now agreed that engineering training should include scientific instruction and practical and commercial experience, but very divergent views were held as to the relative importance of the different components of such a training, and as to the order and duration of each. No system of engineering training could be arranged to meet all special demands, and it was the object of the Conference to find out what was most essential in all courses of training and what modifications were practically possible to meet different cases. At the outset, a professional career was aimed at, and the system of engineering education must be arranged to meet that condition. It was only by educating many that the few could be found who had the capacity and character necessary to achieve considerable advances and to do the work of national importance. Very few young men at 18 could foresee into what line of employment they might be driven, and consequently the first, or undergraduate stage of education must be broad, so as to fit students for widely different spheres of work. Perhaps the greatest defect of engineering education at present was the want of more provision for the higher, and more specialised education of the few students of real capacity, discovered in the sifting process of an undergraduate course. A certain jealousy of college education was still obvious in some practical engineers. While conceding in words that some scientific education was necessary to an engineer, they would, in fact, confine it to very elementary matters. He believed the idea that a college course unfitted a man for practical work was a wholly mistaken one. An employer who took into his works college students was often disposed to expect from them an immediate availability, which was unreasonable. The college course must contemplate the fitting of a student for his whole career, and provide him with an intellectual equipment which would only gradually become useful as he rose to higher rank in his profession. The view of the employer who looked only to the immediate usefulness of the student was a short-sighted one. Nevertheless, a college course was an unpractical and badly designed one if, at the end of it, a student was not more capable and useful from the first, in any type of workshop, than a lad without such a training. The college discipline was bad if he had not much more character and energy than the raw lad. His training had been a failure if he did not pick up the specialised details of any business to which he might be put far more rapidly than an untrained lad. Those practical engineers who were implicitly, if not openly, hostile to college training, exaggerated the value of such workshop experience as an ordinary appentice got. In general, apprentices were left to pick up what knowledge they could with very little help, and in many cases a good deal of their time was absolutely wasted. The engineer worked with his head, not with his hands, and manual skill was of use to him only in very exceptional cases. The knowledge which came to those in responsible positions was not open to the ordinary apprentice, and he learnt slowly, if at all, unless he brought to the works such a knowledge of principles and methods that he could interpret for himself what he saw. No system of workshop apprenticeship could be considered satisfactory unless someone was specially charged with care of the apprentices, whose duty it should be to make sure that they had an opportunity of seeing a great variety of work, and to help them over their difficulties. He believed employers would find—some of them had found already—that they owed a debt to the college, and that the college-trained student would prove, with a minimum ef special experience, a valuable assistant, and in some cases the originator of a real advance in practice. In return, the employer might be a little more ready to give college students a year or two years' run of the works, either without remuneration or with a small remuneration, just enough for disciplinary purposes.

PROF. J. E. PETAVEL, who followed with his paper on "The Relation of Engineering Employers and Colleges from the Point of View of the Practical Training of College Students," considered that the partial employment system, whereby a student spent part of the year at an engineering works and the remainder in attending college classes, had as its most serious objection the fact that it upset the routine of the works. The university should endeavour to provide sufficient facilities for acquiring the requisite education, being there for that purpose, and for the use of the student, not the student merely as a support to the university. If the system pursued by the authorities in teaching engineering was such as to separate out the students so as to form them, as it were, into a separate section or class, they began to lose the advantages of the corporate life of the university. Properly speaking, they should be on precisely the same footing as the rest of the students. With regard to laboratories, the difficulty was more obvious, as it was undesirable to have workshops at a university, and yet something of that nature could not be wholly dispensed with. He would emphasise the fact that the laboratory course and practical training were not mutually interchangeable. It should not, however, be necessary to send a student to the university to become acquainted with the use of file, hammer and lathe. The kind of laboratory which was essential was one containing examples of typical modern machinery.

MR. J. W. HORNE then read his paper advocating an arrangement whereby employers of labour should be asked to give facilities for the training of the most suitable students. Engineering firms in this country had developed a very keen interest in the better education of the ordinary apprentice, who started apprenticeship at 16 years of age. Every encouragement was given them to attend continuation classes, and several firms allowed the best of them to attend classes one or two afternoons a week. He suggested that such apprentices should be benefited by a scheme by which the best of them would be afforded the advantage of systematic scientific education in the daytime, at one of the fully equipped colleges.

MR. ALEXANDER SIEMENS wished to consider the subject from an employer's point of view. He attached particular importance to the fact that it was frequently impossible for manufacturers to take students independently of vacancies. They were, of course, perfectly willing to do so when the vacancies were there. Referring to Mr. Horne's suggestion, to allow apprentices to take time off for outside classes was impracticable. When admitted to the works they must keep the regular working hours. If absent for an afternoon a week, they might as well stop away altogether. He referred, as a Commissioner of the '51 Exhibition, to the system which was one of the fruits of that educational revival, whereby lads who displayed exceptional ability could qualify for annuities of £100 to £150 per annum.

PROF. GISBERT KAPP said that Mr. Horne's suggestion was at present being carried out in Birmingham for clever boys from the secondary schools. The University authorities were eager to assist boys in securing education, and the City of Birmingham had so increased its grant to the University that it was possible to give maintenance and scholarship allowances to a certain number. Personally, he believed in the utility of the sandwich system, but, as often worked, the "slice" was too thin. University vacations lasted nominally from three to three and a-half months, and of this three weeks should be real holiday. Many employers had inquired for the best class of student to work under them for the long vacation, and the results were most satisfactory. In Scotland longer time could be spent at the works, but this was not so in England, were the arts, science and technical students all worked together. His suggestion was four years under professors and three years at works. Why not divide into slices of one year each, *i.e.*, one year at college, then 14 months in the shops; followed by another year at college and 14 months at the same works, and finally a year at college?

MR. FRANZ ZUR NEDDEN said that in Germany the whole subject was under consideration by joint committees of all the leading engineering institutions. Their recommendations were:—

1. By unanimous resolution of all the leading Universities, that no young man should be allowed to enter as a full student who had not passed 12 months in the workshops of an industrial works or repairing shop.

2. A code of rules as to the conduct of the training by those responsible for the management of these works. These nearly coincided with the rules of the Institution of Civil Engineers of 1906, and were still adhered to after 12 years of experience in working.

3. An official list of leading firms declaring themselves willing to accept students under these rules, compiled for general information.

The general opinion was that one year in the works was not sufficient, and an extra year after, or small periods sandwiched in between University courses, were suggested in addition. The principal difficulty was to ensure freedom from loss to the industrial firms taking students. Whereas Universities had plenty of money to spend, industrial concerns had no fund to pay for education in their works. The manager must necessarily look to his dividends and to immediate results, not to the benefit of the next generation. It was suggested that manufacturers should be allowed to take a premium from the students, and should be obliged to allocate a certain percentage of this to the payment of a special official as teacher, or to provide a good library. It would probably be best for working-men students to participate in the benefits derived from the expenditure of this sum. Students should do all their practical work in one factory, and put in a final six months after completing their college course. This would assist in promoting works *esprit de corps*.

MR. J. F. C. SNELL said that it was an undoubted fact that the student was unsuited to proceed to the works direct from school. Personally, he believed in completing the technical training before going into the works. He deprecated the 12 months' break in theoretical work as bad for the student. The sandwich system could only be regarded as a compromise. The best system appeared to be to go from school to college, and then, at some such age as 22, to enter the works to learn the essentials of engineering. The college-trained student was of more use to the employer after the college course than immediately after leaving the public school. He would emphasise the value of the drawing-office training. This should be brought out more clearly. His final suggestion was that the Institution should appoint a sectional Committee of their body, which, in conference with educational authorities, and the heads of the great engineering firms of this country, might watch over the education question and do much in future to aid the student and, through him, the profession in general.

MR. B. HALL BLYTHE said that, as a civil engineer, he was far from objecting to the college course, but he did object to the theory that students who had completed such a course were fitted at once to become wage earners. It was obvious that, even at the end of a four years' apprenticeship, the student had still much to learn.

PROF. J. WERTHEIMER considered that very few people really held the view which the last speaker had criticised. The Massachusetts Institute of Technology at Boston turned out several hundred engineering graduates annually, considerably older than the British graduate. They were able to boast that

each one of these found employment at a small commencing salary. This was not the case in this country, and it would be interesting to inquire into the reason. The works here necessarily wanted the best young men they could get. Years ago in Bristol it was very difficult to find posts for men leaving, but the works now wrote asking for a similar man to the one they had already from the same institution. As a general rule, colleges were not sufficiently stern in weeding out unsuitable students. At the University of Bristol they got rid of a considerable number, who showed in the early stages of the work that they were unfitted for the profession, by advising their parents to withdraw them, thus retaining only those who would ultimately derive benefit from their studies, and be useful members of the profession. As regarded evening-school students, the very capable artisan to be found therein was provided for in Bristol, by being allowed to take his degree by a long course of study. Also a limited number of scholarships for the artisan student were in existence, and it was desirable that these should be extended so as to include an allowance for maintenance, as at present very few young men were able to take them up, owing to the necessity of providing for themselves during the period of study.

SIR WILLIAM WHITE said that, with reference to the comparison made by Principal Wertheimer, it must be borne in mind that conditions in England and America were fundamentally different. So far as the value of education with reference to obtaining employment was concerned, young men trained here also got work in the United States and Canada. Cases had certainly come to his knowledge in which the college-trained men displayed so superior an attitude towards possible employers as to render their engagement extremely unlikely. He also would like to protest against the assumption that any young man could be made into an engineer by merely undergoing a college course. It was highly desirable that the aptitude of the student should be ascertained as early as possible. He thought Mr. Snell had misapprehended the proposal. In any case, instruction must be paid for, whether at college or at a works. The employer could not keep his office going as a philanthropic institution.

MR. H. J. SPOONER warmly approved Mr. Horne's note on united action between the Imperial College of Science and the polytechnics. Personally, he would welcome such action. He joined issue with Prof. Petavel on the subject of college workshops. A great deal of work could be done there most efficiently. For instance, many workshop tools could only be handled by technically-trained workers. College workshops could instruct as to the handling of these tools.

PROF. SILVANUS P. THOMPSON ventured to differ from the chairman in the matter of the attitude of employers towards college-trained men. His experience was that firms were eager to get them, though possibly more eager to employ than to pay. He would also differ from Mr. Snell in his proposition to defer the workshop course until the technical training was completed. Experience in the shops rendered the college training much more real and beneficial to the student. As regarded the difficulties of combining the two, he agreed with Prof. Kapp that, though desirable, it was not possible to bring English college courses into synchronism with the Scotch. At Finsbury College the two years' course could easily be taken between school and workshop, or it could be taken between the ages of 21 and 22 years by those who had served an apprenticeship on leaving school. The question of degrees was another consideration not necessarily involved.

MR. W. H. PATCHELL thought that if the colleges could alter their terms so that they extended over the 12 months in the same way as the works year, it would simplify the carrying out of the sandwich system. It should be possible for college systems to give a regular supply of boys, and these should be employed in the regular work of the industries to which they were to be attached. Supernumerary work was bad for the boys, especially as an initiation. The way in which expenditure was made on education was at present unsatisfactory. Too much was spent on all boys, and too little on those who showed especial aptitude for the profession.

Time did not admit of the authors replying to the various points in the discussion.

In Section II, on the second day, a paper on "The Value of a University Degree in Engineering Science in Relation to Professional Competence," was read by Prof. S. M. Dixon, who said the competent engineer was one who could deal effectively with materials and men. The theoretical part or basis of the engineer's education was that which was more or less complete, as far as most men were concerned, when they received the degree in engineering. The practical part of his education, beginning at college, should continue as long as the engineer remained in practice.

The work carried out for the degree must deal mainly with principles, and should be as broad as possible. Details of current practice would be noticed only as illustrations of principles.

A liberal education was essential: literature, history, philosophy should be studied, and this was even more necessary in the case of engineering students than in the case of those who intended to follow other professions, for, owing to the nature of his employment, the engineer frequently had for several years few opportunities for reading outside his work. The general culture which came from college life as well as from college study was an asset in the engineering profession, not to be despised and not easily obtained.

While in other professions, a University degree was regarded as the first requisite, and so led directly to employment, there was still a feeling in some quarters that the University graduate was rather in the way in an engineer's office. Matters, however, in this way were improving. Once engineering firms recognised the advantage of having assistants thoroughly trained in the principles underlying practice, and whose training also specially fitted them for adopting new ideas rapidly, they would be only too glad to co-operate with the Universities in completing the education of the engineer. The greatest gainers in the end will be the employers, while at the same time the status of the junior engineer will be greatly improved.

Dealing with the same subject, PROF. C. F. JENKIN said that engineering education should consist of three parts: a basis of general scientific study; a middle structure of applied science, that is of science specialised, extended and adapted with a view to its bearing on professional practice; and, lastly, that kind of knowledge of practice which could be gained only by coming directly in contact with it. The last could only be obtained by an apprenticeship or its equivalent. A degree was a very much better proof of the possession of a good theoretical training than any examination could be. The degree course contained much that could not be included in the examination at all. The value of laboratory training, which could only be obtained in a college, was very great. The teaching in the drawing office in the preparation of actual designs, and the field course of surveying were all applied in the degree, but it was almost impossible to take any account of them in an examination. To spend some years at a university was an education in itself, and would be a permanent asset in the boy's life. If the engineering profession was to be brought under State control, as medicine was, and also the law, it would appear to be wise to make the basis of qualification as broad as possible by recognising the engineering degrees of the universities as a necessary qualification.

In opening the discussion, MR. W. H. MAW said he did not agree that possession of a University degree should entitle its holder to higher remuneration than would be given to one who had not a degree. He admitted that a well trained man with a degree might be expected to advance comparatively rapidly in his work.

PROF. J. A. FLEMING said his view was that the value of a degree at present was very small. The vice of the present system was that the examination was largely if not entirely written. Sufficient attention was not given to practical work. The best kind of memory was that which enabled a man to recollect where he could find information on any particular subject. The engineering profession was analogous to the medical profession in that what a man knew was not so important as what he could do. Reliability, resource, and accuracy were essential; and they were only to be got by experience. The whole system of examination must be entirely altered, and practical and *viva voce* examination must be substituted for the present system of written examination. He would prefer seeing the degree abolished and replaced by a diploma.

MR. DUGALD CLERK, speaking as an employer, said he found that men with a degree were not so inefficient as Prof. Fleming's remarks might lead them to expect. In his office he had five B.Sc.'s of Cambridge, Glasgow, Manchester and Cardiff. They had had practical as well as scientific education, and he was quite sure they could all give a vocal account of the second law of thermodynamics. He thought that Prof. Fleming's system of teaching must be wrong. He would admit that in works such as those of the National Gas Engine Co., where they had 1,500 hands, a B.Sc. degree was not of any great value; but he was convinced that scientific education saved much bungling experiment. He quite agreed with the authors as to the value of a science degree; but he had found some Oxford men were extremely conceited, and laid down the law on entering the works, and tried to teach the employers their business.

MR. A. P. TROTTER said his view was that a degree should not be given by any university in connection with the engineering profession. He maintained that the underlying principles of the sciences affecting engineering should be taught at universities and colleges. The enormous amount of money spent on engineering education in America had resulted in a large crop of swelled heads, but matters in that respect were now improving. He trusted that teachers would add to the proper foundation of the science rather than to details, for correct principles were unalterable, but the design of a switchboard would be out of date in a few years.

COL. B. R. WARD expressed the view that a sound general education, including the literary side as well as the scientific, was most valuable, because the literary subjects brought one into touch with life, and enabled one to deal with men and affairs, and of such subjects the chief were history and general literature. A man who had not so studied might be able to deal with engineering, but mere ability to carry out engineering work was only half the engineering profession, and the ability to deal with men and matters was the other half.

MR. JAS. GLOVER urged that universities should impart general principles and avoid the technical details of engineering. His experience was that the difficulty lay in the lack of knowledge of theoretical principles, and not of practical application. He thought it best that a man should acquire only the general principles before entering an office or a workshop, and advocated the replacement of the present system of apprenticeship by direct remuneration, which should be increased as a man's aptitude for his work progressed.

PROF. SILVANUS THOMPSON said that the desire to put a string of letters after one's name was becoming a serious national failing. At present they were suffering from the curse of running after those degrees; and men studied only for the degrees, and had no time to digest the information which they acquired only for the examination. They thought more of getting the degree than they did of the actual

work; and the harm which was being done at the present time to the cause of higher education could not be expressed in a few brief sentences. It was a curse that men ran after the hallmark and ignored the substance. There were many employers who would look favourably on a B.Sc. degree, but not on an A.R.S.M.; but he was strongly of opinion that the A.R.S.M. or the diploma of the Central Technical College should carry far more weight than the B.Sc.

(*To be continued.*)

LEGAL.

THE NATIONAL TELEPHONE TRANSFER.

(*Concluded from page 52.*)

MR. S. Z. DE FERRANTI was next called.

MR. DANCKWERTS, K.C.: Speaking generally, what do you say with regard to the suitability of the plant which has been objected to?—The plant which has been objected to seems to me to be suitable for at least two reasons. The first is that the plant which is now being used to serve the public cannot fail to be of very great advantage if used in connection with the unified system, to come into being at the end of this year, if it is used for the purpose of bringing about a gradual change. Secondly, the whole plant seems to be useful, because where plant and apparatus is taken out of certain exchanges it can undoubtedly be used again in smaller exchanges in progress of being carried out, or which will be carried out, in different parts of the country, to take care of the growing business. For these reasons I think all the plant is suitable.

WITNESS said he had visited the Avenue exchange and spent some time there. He was particularly struck by the fact that this exchange, which was said to be an old one and obsolete, gave such admirable results and such a quick service. It did this at a cost in wages which could not be considered as other than satisfactory, considering the service given. The plant was in good repair, and there was nothing to suggest that it was becoming obsolete or was unsatisfactory for the purposes of the telephone service. There were a number of pieces of plant there which were perfectly good for the purpose of taking out and applying somewhere else.

You notice the objection which has been taken to the placing of telephone lines "across, along, &c.," electric railway lines?—Yes; that seems a most peculiar and quite unreasonable objection, in my opinion. There are now only comparatively few electric railways, but the number and extent of them will grow enormously, and electric power cables for railways and for other purposes will be placed all over the country in every direction. It will be impossible, therefore, to avoid laying cables for telephonic purposes and electric power cables in close proximity with one another. The country will be so covered with them that it will not be possible to keep them apart. I see nothing from experience to justify the contention that the close proximity of these two kinds of cables means danger to life and property or unsuitability of working.

On railways themselves are the telephonic lines used for the purposes of the railway companies?—Yes, a good case was given by the last witness of the telephonic lines along the Central London Railway system. There are also a considerable number of telephonic cables laid along the District Railway system, and these cables are well placed and satisfactory. The time has already come, or nearly so, when every available telephone route through London should be used and made the most of; therefore, the cables through the District Railway should not be abandoned, as they are very valuable for the telephonic needs of London.

The underneath parts of the streets of London are full of all sorts of pipes and plants abandoned and not abandoned?—Yes, they are full to an extraordinary extent; to an extent which no one who has not had the difficulty of finding routes can possibly appreciate. And the abandoned plant is the most serious. When I, myself, have been engaged in dealing with plant in the Strand, I have taken up disused mains belonging to five different companies, and in doing so have broken into a live main. The congestion underground in London streets is far more serious than the congestion above ground.

Do not the electric railway companies in London use the telephone system?—Yes, they are obliged to in order to carry on their business; the telephone is an absolute necessity for them, and it is a convenient thing to lay the telephone lines along with the power lines. This practice has been so successful that it is now generally adopted. Provided this work is properly done, and reasonable provision made, there is no danger in the proximity of telephone wires to power lines. Only yesterday I had a test made to see the effect of short-circuiting a 400-volt power supply into a model telephone exchange. I had the experiment repeated a number of times, and in every case the protection devices acted perfectly. The fuses cut off the wires without any apparent disturbance and no difficulty. If telephone exchanges are fitted with modern protective apparatus, there can be no trouble or danger arising from the telephone wires coming into contact with high-power circuits. The accident which occurred at the Bank exchange when the District Railway was being converted, has been mentioned during the course of this case; may I state that had these methods of protection been fitted at the time, that fire at the Bank would never have happened. But, of course, it has been explained that the work was not completed, and there was a misunderstanding.

Is it a perfectly safe method to lay high-power cables and telephone wires in the same duct or trough?—Oh, yes; I have had a large experience of cable-making and laying, and that is very often done. To-day high-power cables and telephone cables are to be found running together in numerous cases, and they are wanted together.

Is it reasonable to suggest that merely because wires for telephonic purposes run along or across railways they should be scrapped as unsuitable?—I think it is a most unreasonable thing to suggest, unless it can be shown that any particular wire has done badly or involved some risk which was not covered by the general principle.

The ATTORNEY-GENERAL, cross-examining: If it were left to you and another reasonable engineer you could arrive at a quick method of arranging all these matters?—I should select people most competent for the work, and then I should trust them.

I understand you to say that the company's plant in use is suitable for the purposes of the Post Office? Do you mean that only the plant you have examined is suitable?—WITNESS said that he meant that taking the plant he had examined as a fair example of the company's plant as a whole, then all the plant was suitable.

SIR ALEXANDER KENNEDY was then called, and said he did not consider there was any separability in the National Telephone Co.'s wiring system.

Cross-examined by SIR RUFUS ISAACS, WITNESS said there was no difficulty in connecting the wires to one exchange and disconnecting them from another.

WITNESS was answering further questions by the ATTORNEY-GENERAL with regard to the objections taken to parts of the wiring system of the company and their separability from suitable plant, when

MR. JUSTICE LAWRENCE asked Mr. Danckwerts what position exactly the company took up in the matter.

MR. DANCKWERTS said the company were going to ask the Court to say that the whole of the Postmaster-General's notices covered suitable plant, and none of the exchanges of the company should be condemned.

His LORDSHIP: We are in a difficulty. It seems to me that until we know what the Post Office scheme is, it is impossible for us to come to a decision upon the matter. He intimated that he did not think Sir Rufus Isaacs should delay in bringing the case for the Post Office before the Court at the earliest possible moment.

A discussion followed on the question of the private wires. SIR JAMES WOODHOUSE said, in his opinion, private wires must be taken over as a whole on the terms of the agreement—that was, so far as they were suitable for the actual requirements of the Post Office service.

The ATTORNEY-GENERAL said he objected to the contention that if a cable contained one private wire and 599 other wires the Post Office must take over the whole cable, whether the 599 other wires were good or bad. If he would meet the difficulty the Postmaster-General was prepared to pay for the private wire on its value, or such wires in a cable which were good.

MR. DANCKWERTS said that would not meet the difficulty.

The ATTORNEY-GENERAL submitted that the objection which referred to suitability had nothing to do with the private wires. The only thing the Court had to deal with was whether the plant objected to was suitable for the Post Office or not. He submitted that the Court could not say that a cable with one good wire and 99 bad ones was a cable suitable for the Post Office service.

Asked if it were possible to separate good cables from bad ones, SIR ALEXANDER said it was not. There was no question of unsuitability.

MR. HAMMOND V. HAYES was next called, and said he carried on business as a telephone engineer at Boston, Mass., U.S.A. He had been actively engaged in telephone work for the last 26 years. Witness became employed by the American Telephone and Telegraph Co., in 1885, and until 1907 he carried out their experimental work and scientific investigation.

MR. MORTON, K.C.: Some of the well-known improvements in telephony which are now in universal use throughout Europe originated, I believe, from you and your assistants?—Yes; we invented and developed much of the telephone apparatus now in general use.

For instance, one of your improvements is what is known as the the solid-back transmitter?—Yes; that is a standard transmitter now in general use.

You are also, I believe, the originator of the central-energy or common-battery system?—Yes; it originated in my department and was developed under my direction. Since 1907 witness had been in private practice, but he still retained connection with the American company as general expert.

MR. MORTON: Is there any difficulty whatever in working the combination of underground cables with overhead wires?—None whatever; on the other hand, we consider it a standard system.

Questioned as regarded the common-battery and magneto system, WITNESS said that in America the number of switchboards with local battery installations were diminishing in the large and crowded areas of the United States; in fact, in such areas the local battery exchange had practically ceased to exist. This was due to the very large increase in the number of subscribers, and the economy of time which might be effected in operation under the central-battery system.

Do you say that the introduction into the exchange of a common-battery system involves scrapping of the existing local battery in that exchange?—It consists of taking out the local battery exchange, and putting the apparatus in a smaller exchange elsewhere. We have never scrapped any serviceable apparatus. Within the last five years there has been more local battery apparatus manufactured and installed in the telephone service than ever before, even in the days when the local battery was the only system in use. The reason of this is that the business of telephony has

developed in the outlying small towns and areas to such an extent that we not only need all the local-battery apparatus which we set free from the large exchanges to supply these small towns, but we also have need to manufacture a great deal more of it.

For small exchanges in outlying districts the local-battery system is more suitable than the common-battery system?—Yes, in the small offices we use it practically exclusively.

MR. MORTON: Do you think it economical to effect a substitution from the local-battery system to the common-battery system in the London exchanges at one time rather than to do it gradually?

SIR RUFUS ISAACS submitted that this was not relevant to the point which the Court had to consider. It was not a question of what was the most economical system.

His LORDSHIP: But is that not one of the elements which we have to take into consideration when deciding the question of suitability? Surely commercial suitability is a thing which comes into the matter?

The ATTORNEY-GENERAL submitted that it was not relative to the consideration of the Court. The question was not what commercial men would do under the circumstances of the amalgamation of two companies. That was an entirely fallacious way of approaching the case now before the Court. The only question really was whether the Postmaster-General was justified in the opinion he had formed that the plant in question was not suitable for the actual requirements of his service on a certain date.

His LORDSHIP thought that surely the question of economy was one which the Postmaster-General must properly take into consideration before making up his mind.

WITNESS continuing, said that in his opinion, it would be an extremely wasteful and almost wicked thing to scrap apparatus which was useful and could be used in connection with the service, simply because it did not happen to be wanted at a particular time.

COUNSEL was proceeding to question witness with regard to the suitability of telephone lines in the close proximity of high-power cables when,

The ATTORNEY-GENERAL said he did not propose to contend that that particular objection was one which could be maintained. Subject to the condition that proper precautions for protection were taken, he did not think the objection could be insisted upon. He would suggest that if any difficulty arose between the parties afterwards as to whether or not any particular cable was properly protected, some engineer agreed upon between both sides should view it and decide the matter. This would be a simpler way of dealing with the question than producing a great deal of evidence and argument before the Court. The Postmaster-General's attitude was that he was bound to take precautions to ensure that any plant which he took over was properly and sufficiently safeguarded. If that were done he was perfectly satisfied, and would not raise any further point about cables or wires laid along, over, &c., electric railway lines and other electric power systems.

Some discussion ensued on this matter, and eventually SIR RUFUS ISAACS suggested that the Court should make a declaration in the form that all telegraph lines in the proximity of high-power cables were suitable, leaving it to the Postmaster-General to point out any specific cases which might arise in which he was not satisfied with the precautions taken. Eventually this course was agreed upon, it being left to the parties to decide the actual terms of the declaration.

MR. HAYES, further examined, said that in America they had overhead trolley tramway systems throughout the country, and in connection with their telephone system they had to make frequent crosses over the bare traction wires in order to get their telephone wires from one side of the street to the other, &c. To avoid the risk of contact with the high voltage traction wires, they covered their telephone wires with rubber, and their cables where they crossed the traction line were supported in such a way that the probability of contact was reduced to a minimum. They also had protecting apparatus identical to the one used in this country installed in the exchanges, and that afforded a complete protection against an outside current causing injury to the switchboard or telephone apparatus. He knew of no case where this protective apparatus had failed in its function.

Cross-examined by the ATTORNEY-GENERAL, WITNESS said that in America they used the underground system for the main arteries in crowded areas, and distributing wires to the subscribers were overhead.

Have you seen the Avenue exchange, and its system of overhead wires?—Yes.

Have you anything like that in America?—Not now, but we had when I began business.

How long ago is that?—Twenty-two years.

His LORDSHIP: I gather there is a city ordinance against the use of overhead cables in the crowded centres of America?—Yes, that is so.

Further cross-examined, WITNESS said that for their overhead distributing service they used lead-covered cables for the most part. It was true they also used india-rubber cables, which were just as satisfactory as lead-covered cables for short lengths. Their overhead lead-covered cables were identical with the cables used for their underground system.

Continuing, WITNESS said that he did not agree that rubber-cased cables were more dangerous, owing to fire, than lead-cased cables.

Questioned with regard to wayleaves and ducts, WITNESS said that in the American cities, generally speaking his company obtained these free of charge. The people were only too glad to get the telephone system laid on. The only reservation was that the company had to reserve one duct for the use of the city authorities.

Further cross-examined, the WITNESS said that all the telephone exchanges in New York were on the common-battery principle. He thought the last one was converted about four or five years ago.

Re-examined, the WITNESS said that so far as he knew the powers of the telephone company in New York to carry on its business there was unlimited. Taking the affiliated systems of witness's company, he should say they had about 10 million subscribers' stations.

MR. JAMES SWINBURNE, consulting electrical engineer, was next called, and said he did not think it was possible to make a sudden change-over from the Telephone Company's system to that of the Postmaster-General. It was difficult enough to do it in the case of a large exchange, but when it was proposed to do it in the case of all the exchanges, the difficulties were increased enormously. To carry out such a change properly, some time must be taken over the process.

After a three hours' consultation, the ATTORNEY-GENERAL stated that the parties had agreed upon the form of the declaration to be made. It would not be necessary to trouble the Commissioners with the details, but the Court would be asked to make a declaration on the form agreed by the parties. That would dispose of everything before the Court that had to be dealt with preparatory to valuation being made at the end of the year.

As to the degree of suitability under Clause 4 of the purchase agreement, that point was still open to be taken before the Court.

SIR ALFRED CRIPPS said he understood the arrangement was that they should leave Clause 4 as it was. It did not affect the agreement. The terms, it was hoped, would enable the matter to be worked out on a strictly business basis.

MR. JUSTICE A. T. LAWRENCE said there would be an order on the terms drawn up.

HARTLEPOOL ELECTRIC TRAMWAYS CO., LTD., AND OTHERS *v.* WEST HARTLEPOOL CORPORATION.

AN application with reference to the hearing of an appeal in this case was made last week in the Court of Appeal, before Lords Justices Vaughan Williams, Fletcher Moulton and Buckley.

MR. MCCARDIE, for the defendants, said the action was brought against the Corporation (for whom he appeared) to recover in substance £12,000, which the plaintiff company alleged was due from the Corporation upon the purchase of a tramway undertaking. The matter was decided a short while ago by Mr. Justice Bray, who gave judgment against the Corporation. His Lordship, however, granted a stay on condition that application was made to the Court of Appeal to expedite the hearing of an appeal, notice of which had since been given by the Corporation. That was the present application. Mr. Jutice Bray expressed the view, added counsel, that the appeal ought to be heard before the long vacation. The question involved was as to whose were the tramways at the present moment; and the company naturally wanted their position defined as soon as possible.

LORD JUSTICE BUCKLEY: Every litigant is more or less in the same position.

MR. TYLDSLEY JONES, for the company, said that the position was a little more complicated than that. The Corporation gave notice of purchase under Sec. 43 of the Tramways Act of 1870 upon the promoters of two lines of tramways in West Hartlepool, and before Mr. Justice Bray they raised the point that owing to the way in which tramways were constructed—that inasmuch as the lines were not constructed by the promoters themselves, they, the Corporation, were not bound to pay for them. The point, therefore, was this: Whether the company were working the tramways illegally, in which case they would be liable to an indictment. The company did not care to be in the dubious position of trespassers on the one hand, or unpaid vendors on the other. If the Corporation were right the company ought to stop working immediately, and the public would in that case be deprived of the use of the tramways. The Corporation had called upon the company to do certain repairs to the roadway. The company replied that having regard to the curious position which they were in they could not do the repairs, and the result was that until the appeal was heard the roadway would not be properly repaired, and should an accident occur who would be responsible he (counsel) did not know.

After further discussion, their Lordships decided to place the appeal on the list for hearing on 17th inst.

ACTIENGESELLSCHAFT MIX & GENEST *v.* HERMANN OPPENHEIMER.

ON Friday, July 14th, in the Chancery Division, before Mr. Justice Eve, this case was heard on motion by the plaintiffs.

MR. DANCKWERTS, K.C., in opening, said the plaintiff company and the defendant entered into an agreement in September, 1905, under which a certain electrical supplies business, which was being carried on at Salusbury Road, Kilburn, under the name of the International Electric Co., was declared to be the property of the plaintiffs. The defendant was to act as manager, and the plaintiffs were to furnish all materials with which the business was to be carried on. It was also agreed that any disputes should be settled according to German law in the German Courts. There was also a provision that if the profits in any two years did not exceed 20,000 marks, the agreement should be determined At the beginning of the present year the agreement was determined, and the *status quo* kept up for a short time by agreement. In February last the plaintiffs began an action in Chancery to get possession of the premises in London and the assets, and an injunction to restrain

the defendant from preventing the plaintiffs entering the premises. The defendant retaliated by moving that the action should be stayed pursuant to the agreement. Plaintiffs had no reply to that, and the only thing left for them to do was to protect the property in the interim. That was recognised by counsel, and an order was agreed in February last by which a Receiver was to be appointed and all further proceedings stayed, defendant undertaking to carry on the business with due diligence, and to give plaintiffs access to the premises. Mr. Pixley was appointed Receiver. Eventually an action was begun in Germany by Oppenheimer, and plaintiffs there asked for an interim order in the Lower Court, which was refused, but it was granted in the Appeal Court. What he (counsel) now asked for was a parallel order to that granted in the German Court for the purpose of carrying out the German order that the business was the property of the plaintiffs, subject to certain deposits. He could not have brought independent action, but only put it forward as an interlocutory matter to say that the German Courts were those which the parties by agreement had said should settle all disputes. The German Court found that the defendant did not deny that the assets of the London firm belonged to the plaintiffs, and that the defendant set up that the goodwill of the International Electric Co. belonged to him. He would point out that Mr. Pixley asked £150 a month for remuneration, while if plaintiffs' nominee was appointed there would be no expense.

In answer to his LORDSHIP, MR. DANCKWERTS said he asked the Court to discharge Mr. Pixley and to appoint one of the plaintiffs' directors, who was now in London. The German action was now proceeding on the point as to whether the defendant was the owner of the goodwill of the business.

MR. P. O. LAWRENCE, K.C., for the defendant, pointed out that up to the present the German proceedings were merely interlocutory, and that there were no pleadings. The appointment of a Receiver was left to the Master in Chambers, and he had appointed Mr. Pixley. He submitted that no grounds had been shown for going behind that appointment. He did not admit that the capital of the International Electric Co. belonged to the plaintiffs. He said the defendant had a substantial interest in it.

In giving judgment, his LORDSHIP said he was impressed with the fact that the continuance of Mr. Pixley's receivership would involve a claim for remuneration, but, on the whole, he did not think the circumstances warranted him in acceding to the motion, which would be dismissed with the usual consequences—costs.

Leave to appeal was granted.

GLOBE ELECTRIC CO., LTD., *v.* A. H. BROOKING & CO.

IN the City of London Court on Friday, before his Honour, Judge Rentoul, K.C., plaintiffs sued Messrs. Brooking, electrical engineers, of Richmond Road, Exeter, for £12 15s. 8d., for six Santoni "Luxrae" arc lamps supplied to them for use at the Carmarthen Skating Rink and the baths at Paignton. Mr. G. S. Stone appeared for the plaintiffs, and Mr. Pratt for the defendants. The order was given on July 22nd of last year, it being marked "urgent."

The defence was that the lamps were never accepted, and never answered the description required, burning only intermittenly.

MR. STONE observed that the defendants kept the lamps for four months before rejecting them.

MR. PRATT pointed out that the defendants had no opportunity of testing the lamps until four months after delivery. Carmarthen had no electrical installation until then: so they could not be tested.

After further evidence had been called, Judge RENTOUL said that keeping the lamps for four months was fatal to the defendants. He found for the plaintiffs, with costs.

SMITH *v.* CLOTHIER.

THE hearing was concluded at the Liverpool Assizes on Wednesday, July 12th, before Mr. Justice Horridge and a special jury, of an action claiming damages for libel, brought by James Smith, electrical engineer, formerly employed by the Bootle Corporation as a switchboard attendant, against Mr. Clothier, borough electrical engineer, the libel complained of being contained in a report by defendant to the Electricity Committee. In this, Mr. Clothier attributed a defect, which occurred on November 9th, to a fault on plaintiff's part, and as a result Smith ultimately lost his employment.

MR. MILLER (counsel for plaintiff) said the defence was that the report was not detrimental; further, that it was true, and written without malice, and was privileged. On the last plea, he was not going to contend that the occasion was not privileged, but he would submit that the report was not written in an honest straightforward manner, stating all that the writer knew of the breakdown of November 9th, but that it was written by defendant putting the blame upon Smith in order to shield the management of the electrical department. The report was actuated by a desire to explain the breakdown, and at the same time to protect Mr. Clothier from inconvenient questions.

PLAINTIFF, in evidence, denied that he had been negligent in not taking steps to remedy the breakdown. He admitted in cross-examination by MR. RIGBY SWIFT, that Mr. Clothier had reprimanded him on other occasions. On January 16th, he told defendant he would make revelations, but did not intend it as a threat.

JAS. B. HUDSON, deputy electrical engineer at the Bootle power station, said that at the time of the breakdown the condition of the switchboard was not good.

By MR. SWIFT: If the breakdown had been threatening, then plaintiff had not done all he ought to have done.

ALFRED JOHN LEIGH, consulting electrical and mechanical engineer, was of opinion that the readings of the records gave no indication of any impending breakdown.

Cross-examined, WITNESS said that assuming the fault was indicated at 2 o'clock, there was nothing wrong in the report, and further, that on the information Mr. Clothier received, and if his experience coincided with the information, he would be justified, in fact, would be called upon by duty, to make the report.

MR. RIGBY SWIFT having addressed the Court for the defence,

The JURY intimated that there should be a verdict for defendant.

His LORDSHIP thereupon gave judgment for defendant, and on the question whether he should certify that the report was written by defendant in the execution of his duty, his Lordship said there never was any question on the point, for in his opening Mr. Miller said it was a privileged occasion.

ELECTRICIAN'S COMPENSATION CLAIM.

AT the Todmorden County Court on the 13th inst., before his Honour Judge Gent, an interesting case under the Workmen's Compensation Act was heard, in which the applicant was Shaw Gledhill, an electrician, of Knott Wood, and the respondents were Simpson Bros., Ltd., electricians, of Hapton.

Applicant was represented by Mr. Watson, barrister, Leeds; and the respondents by Mr. J. C. Waddington, Burnley.

It appeared that Gledhill was working for the respondents doing electrical work at Messrs. Wilson Bros., Bobbin Works, Cornholm, Todmorden, on October 13th, 1909, and he met with a serious accident, by which his left forearm was broken. His left arm became entangled in an electrical wire, and he received a fracture of the lower arm and injury to the muscles. His average wages were 32s. per week.

Respondents alleged that applicant was not totally incapacitated, and that he was able to follow some business.

APPLICANT said he was 22 years old, and married. He served his apprenticeship with Messrs. Adamson, electrical engineers, Rochdale, and afterwards became engaged to the firm of Messrs. Simpson Bros., of Hapton. He was putting in electric light installation at Messrs. Wilson Bros.' works at Cornholme Bobbin Works, and was working on some scaffolding that had been erected over some shafting. While engaged in wiring, a part of the cable was caught by the shafting and was coiled round his left arm and twisted round the shafting. The engine was stopped. For 17 weeks he had his arm in splints. His wages were 32s. per week, and from the third week after the accident until May 27th of the present year, the respondents had paid him 16s. a week. Since the accident he had done no work.

DR. JOHN STEPHENSON said respondent was not able to do the work of an electrician, as the muscles of the left arm were very much wasted.

MR. SIMPSON, managing director to Messrs. Simpson Bros., Ltd., said applicant was engaged by the job at 7½d. per hour, and that case would not have arisen if the orders he gave to his foreman not to work over moving shafting, had been observed.

DR. SINCLAIR, Burnley, said he had examined the applicant, and he thought he could do the work which Mr. Simpson had offered him.

MR. SIMPSON said the applicant could go as an assistant.

DR. SINCLAIR said, if the applicant tried his best, he thought he could do anything that an electrician was called upon to do. If he did not use his arm it would get worse.

It was decided that applicant should return to his work on the 17th inst., and do reasonable work, and that the case be adjourned to the October Court.

HIS HONOUR said they would find out whether the applicant would be able to go as a first-class man or as an assistant. He thought he was entitled to the costs of the application, and that he ought to be paid compensation up to the time he resumed work.

The case was then adjourned to the October Court.

ELECTRICITY IN SILICA WORKING.

IN the Chancery Division on Monday, July 17th, Mr. Justice Swinfen Eady heard an action brought by the Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, against Silicaware, Ltd., Upper Thames Street, London, in which plaintiffs asked for an injunction against the defendants for an alleged infringement of letters patent for an improved electro-chemical plant for working silica.

Mr. Walter, K.C., with Mr. A. B. Shaw appeared for plaintiffs, and Mr. Bousfield, K.C., and Mr. Colefax were for the defence.

Defendants denied infringement, and pleaded prior knowledge.

MR. WALTER, in opening, said the letters patent, dated 1904, related to improvements in the manufacture of silica. Silica was a body very difficult to fuse, and until some time in the thirties or forties no one had been able to do so. Mixed or combined with potash of soda or lead, it had been known for years in the form of silicates as in ordinary glass. The fusing point of glass was 800° C. In the working of silica the material was worked at 1,800° C., and the workmen had to be enveloped in asbestos. It was impossible to work silica by the same process as that used in glass manufacture. Silica had to be worked immediately, because it solidified 16 times more rapidly than glass. When it was in a soft condition, it skinned over almost immediately. The patentees of plaintiffs' device were Dr. J. T. Bottomley, a well-known scientist, and nephew of Lord Kelvin, and Mr. Arthur Paget, now Sir Arthur Paget. After many

experiments they discovered a method of working silica commercially as follows :—They mounted a carbon rod between two electrodes of an electric furnace. This was surrounded by sand. By working to a temperature rising to 1,800° C., a melting action took place which eventually formed a cigar-shaped piece of silica round the carbon resistance of the furnace. It was here that the gases which were thrown off by the process were used in a curious manner. As they were thrown out from the carbon core, they formed an envelope between the core and the silica enabling the former to be withdrawn. No one hitherto had believed that this material, except in the furnace flame could be dealt with, because, as he had said, the heat disappeared with enormous rapidity, and a skin formed immediately. The patentees, however, discovered that when sufficient force had been used to break this outer skin there remained underneath a plastic mass, which could be easily worked like glass. This was what plaintiffs' patents embodied, and counsel produced great vessels which, as the result of this discovery, had been blown in silica and were specially suitable for the storage of strong acids; also silica tubes, beakers, mortars and pestles, &c. The current used in the process, he said, was, roughly, 1,000 amperes at 15 volts for half-an-hour. The result of the discovery had been to reduce the price of silica from £20 to 1s. per lb. Defendants were a company who were manufacturing similar articles in silica abroad and were selling them on the English market. From inquiries, &c., they had made, plaintiffs had come to the conclusion that defendants were infringing their process.

MR. DUGALD CLERK then gave evidence. He said he had examined the plaintiffs' plant, and had examined the past history of silica working. He was convinced that there was nothing in earlier specifications similar to the plaintiffs', which was undoubtedly a useful invention.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Enclosed Switch Fuse.

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.E., have brought out a new totally enclosed D.P. switch fuse, of which we give an illustration in fig. 1. This switch fuse is totally enclosed, and can be made gas and water-tight; Koolark patent cartridge fuses are employed. For above 50 amperes

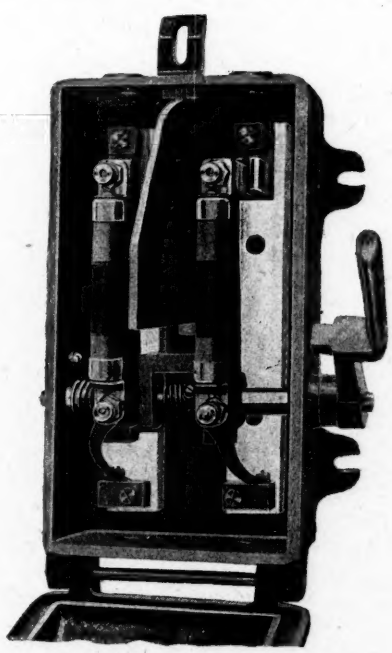

FIG. 1.—ENCLOSED SWITCH FUSE.

capacity no other insulating material except mica is used—that is to say, the switch is composed of metal and mica only. All switches are suitable for a 600-volt circuit, and are asbestos lined throughout. The switch is of simple and robust construction, with quick make and quick break, and is interlocked with the cover so that the case cannot be opened when the switch is closed.

Adams "Igranic" New Patent Starter and Regulator.

The combined starter and regulator illustrated in fig. 2, is fitted with a speed limiting device, and is suitable for shunt or compound wound motors. For controlling motors driving machine tools, when shunt field regulation is employed, it is desirable to have a ready means of limiting the highest speed attainable during any given operation. In these starters the field resistance contacts are inter-connected with a supplementary field regulator, which is mounted on the starter front. When starting up a motor by one of these starters, the handle is always moved right over into engage-

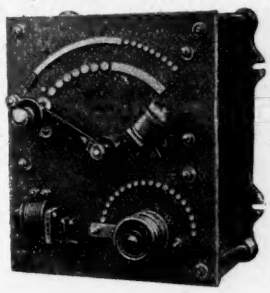

FIG. 2.—COMBINED STARTER AND REGULATOR.

ment with the hold-on magnet, the amount of resistance inserted in the shunt field circuit being predetermined by the position of the supplementary regulator handle.

The regulator is readily set for any desired speed, and when once set, the speed attained by the motor in repeating any given operation will be the same every time it is started up.

The overload release (when fitted) and the no-voltage release are always in operation, and the motor always starts on full field. The illustration shows a combined starter and regulator fitted with overload and no-voltage releases. The apparatus is made by the ADAMS MANUFACTURING CO., LTD., of 106, New Bond Street, W.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cheap "Stannos" Wiring.

I should be glad of your indulgence for a few remarks anent the correspondence in last week's issue under the above heading.

I am in the employment of a firm of electrical contractors, and it is part of my duty to prepare estimates, and dissect the costs of the varied work carried out by the firm. I am deeply interested in the remarks and figures of your correspondent, and have accordingly endeavoured to analyse the figures given from the information contained in his article, and beg to state that I cannot accept them as accurate.

I gave below an amended cost, from which you will observe that the prices of the wire have been altered, and the cost per point is thus brought above the average of 8/2 previously quoted :—

Cost of wiring premises of Mr. S—— (butcher) for 10 points.

Labour, 16 hours at 1s. 2½d.	£0	19	4
Wire, 110 yd., 1/18 "Stannos"	1	15	7
„ 6 yd., 3/20 „	0	2	6½
Fittings, switches, fuses, shades	0	14	6½
Lamps, 10 at 1s. 8d. each	0	16	8
Cast-iron "Z" house fuse-box...	0	2	8
Sundries	0	3	0
Total	£4	14	3
Per point	0	9	5·1

It is apparent that a main switch has not been included in this cost.

The labour works out at 2d. per yard of wire, including the erection of fittings, and this low cost suggests that obstacles in the form of 29-in. stone walls and lack of plant, were not encountered in this instance.

The circuit wire per point works out at 83 ft., a large amount for a small shop on the concentric system, and suggests that a fair number of branch switches were installed. This would account for the low cost of labour per yard of wire to some extent, as a large portion of the wires would be bunched and the labour entailed in cleating up several wires would be little more than that of cleating up one. I would here point out that where a number of switch wires have to be brought back to one position, the material cost of "Stannos" wiring is not economical on account of the

high price of the wire, and I have in mind such instances where the cost have been decidedly in favour of casing and even tubing with 600 Ω class V.I.R.

The average price given by Mr. S. C. Hughes is for jobs with an average of seven lights, where all the lights can be connected on one circuit, and where the mains usually are a negligible quantity, and it is an open question whether these small jobs could or could not have been carried out as cheaply with other systems of wiring. I am dealing purely with the question of initial cost, as the system of wiring to be adopted also depends upon the nature of the business and the construction of the building where the installation is to be erected.

Engineer.

New Heating Element.

We notice in your issue of July 14th a description of a new heating element, consisting of a wire upon which beads are threaded like flexible conductors used in arc lamps, &c.

You characterise it as "a simple device, which strikes one as obvious and absurdly simple, after some one else has invented it." Whilst fully endorsing this view, will you permit us to point out that we used this identical type of element in our electric water-heaters or geysers more than 10 years ago, but have practically discarded it now in favour of some other and better type of heater, so that the "new element" is, after all, of respectable age—measured by the rate of electrical progress.

Isenthal & Co.

London, W., *July 14th*, 1911.

REVIEWS.

Motion Study. By FRANK B. GILBRETH. London: Constable & Co., Ltd. 1911. Price 4s. 6d. net.

At the first glance the title and contents of this book appear to advocate the scientific investigation of matters for which much simpler treatment would suffice. Further perusal quickly removes this impression, whilst a careful study convinces the reader that he has stumbled upon one of the most important developments of recent years. The "motion" referred to is that of the workman or labourer when doing his work, and although appliances and tools have an important bearing upon this subject, it is found that the actual motions may often be modified, altered in sequence or reduced in number with greatly increased results.

Mr. Gilbreth applied his principles first to bricklaying as being one of the oldest and simplest industries in existence, and he has been able to treble the output of the best bricklayers by reducing the work to the fewest and most effective motions in conjunction with improved appliances.

Although the principles put forward are particularly applicable to handwork as distinguished from machine minding, the latter duty involves a great many human motions, and these occur largely between actual cutting operations, hence "motion study" should and does enable us to increase the output of the machines by simplifying the operations of the minder.

It is not contended that "motion study" has been hitherto entirely ignored, but the results obtained through its agency in the most up-to-date undertakings have proved the need for further investigation.

The following excerpts will perhaps give a better idea of the scope of this work than any abstract of the contents:—

"A bricklayer can stoop over and pick up anything from the floor with one hand with much less fatigue if he has a place to rest his other hand while he is stooping."

"Under scientific management. . . . When a man is prevented by causes beyond his control from doing his regularly assigned work, he is told to use the opportunity for rest, not to take such rest as can be obtained by making slow and useless motions, that will give him an industrious appearance to the casual observer, but to rest the 100 per cent. kind of rest."

"There are cases where chairs and reading tables have been provided with beneficial effect for workers to occupy when delayed for a few minutes. They get the rest, and their presence at the table acts as a danger signal to the management."

Under the heading "Nutrition," the author says:—"This is a subject that has been investigated much more scientifically with regard to horses and mules than with regard to workmen."

"Provide something to lean his shovel against . . . when he (the labourer) is alternately shovelling and wheeling, to cut down time and to reduce the fatigue of stooping over and picking up the shovel."

"No worker should ever be obliged to furnish his own tools . . . (due to their having too much thrift, lack of money or fear of having them stolen, they usually use one size only of the same kind of tool). Again . . . they use them after they are too much worn."

"One sees occasionally a machine that can have any and every lever operated without the operator taking a single step; but comparatively few machines are constructed with this in mind."

"The average machine to-day is designed for a short demonstration of quick output, with less regard for the least percentage of rest required for overcoming fatigue due to continuous operation."

Mr. Gilbreth contends, with some reason, that every trade must be reclassified with a very careful separation of the motions requiring skill from those needing strength only. He also maintains that apprentices are taught wrongly by being urged to make a good job first of all followed by efforts to do the work quickly, his system being to teach the most effective motions to begin with, the quality of the results being reserved for improvement after the correct movements have been acquired. This system has always been pursued in the training of soldiers and athletes; in fact, it is doubtful whether any other method would be effective, yet no attempt is made to instruct the workman in the most effective motions for doing standard repetition jobs. It may be contended that a good workman will naturally adopt the quickest ways of doing his work, but abundant evidence is given by the author to disprove this contention, the best results being only obtained by the careful timing and study of a trained scientific investigator.

The aim of "motion study" is to augment the output of the workman without involving any increase of bodily effort; hence this innovation should be welcomed by the trade unions when its effects are understood.

"Motion study" is applicable to every industry involving a repetition of human movements; hence this subject should receive careful attention in almost every concern where labour is directly employed.

Public Ownership of Telephones on the Continent of Europe. By A. N. HOLCOMBE, Ph.D. London: Constable and Co., Ltd. Price 8s. 6d. net.

This treatise is an unbiased statement of the principles, facts, methods and results of telephone administration and development on the Continent of Europe. The author—the Instructor in Government at Harvard University—has spared no pains in the preparation of his work, and has been fortunate in securing the assistance of authorities connected with the commercial, technical, administrative, labour and social phases of telephone working.

The book is divided into four main parts; in the first three German, Swiss and French telephones are considered in 188, 52 and 84 pages respectively, while in the fourth section "other European countries" are dealt with, and various comparisons and conclusions are presented. For most purposes, the book may be regarded as a complete survey to date of all other than purely technical telephone matters in Germany, Switzerland and France. The treatment given to "other" European countries is derived from secondary sources, and is less valuable than the remainder of the treatise, though a considerable amount of information is compressed into the 38 pages devoted to these countries. Why our own telephone system should be omitted from all but digressory treatment in such a work (though England is certainly not *on* the Continent) is a matter for wonder and

regret. In any case, Russian telephones are surely worthy of some mention.

The development of telephone administrative bodies, the evolution of rates and the conflict between telephone and heavy current electrical interests in Germany, Switzerland and France are very fully considered. There are copious digests of various official reports, and though some of this matter may prove of limited utility to general readers, its value as a historical record of fact is enormous and its authority appears unimpeachable.

Technical progress is dealt with only so far as concerns its general nature and significance in various areas, and there appears room for a rather more detailed review of technical matters in future editions. Also, the author should remove such blemishes as "a power of not more than 500 volts" (p. 327) and "the rate of change of the force and direction of a current is more significant than its quantity so far as concerns the phenomena of induction" (p. 310).

Speaking broadly, the author is strongly in favour of public ownership of telephones, though, true to his consistently unbiased attitude, he is careful to point out the numerous defects to which it is liable. Monopolistic control tends to avoid duplication of plant and suicidal rate-cutting as well as to provide the best interconnection of subscribers. Unrestricted competition may lead to a distribution of economic interests unfavourable to the community as a whole, but monopoly, in such a field, must be thoroughly controlled by public authority or it may become unreasonably burdensome to its customers. In almost every European State it has been the previous public ownership of the telegraph which has compelled the telephone monopolist also to be the State. The users served and the services rendered are the same in both cases and permanently independent control of the two means of communication has generally proved impracticable. It is a notable fact, however, that private ownership under proper public control has never been given fair trial.

Public bodies differ much less than would at first sight appear from private bodies, so far as concerns telephone administration; but it is always necessary to replace the pecuniary self-interest stimulating the private telephone company by a suitably organised public control over official administrators. Rightly enough, Mr. Holcombe has nothing but praise for the admirable arrangements in Germany and Switzerland, whereby the wishes of customers are speedily brought to official notice, and, as far as reasonable, readily enforced. The success of the German and Swiss methods are, however, largely dependent on the characteristics of these nations as a whole, and it is the idealistic, unpractical and anti-co-operative temperament of the French which is chiefly responsible for the deficient past and present administration of their State telephones. In Switzerland, the organisation of telephone administration is efficient technically and commercially, is thoroughly democratic, and gives a cheaper and wider service than could be conceived under any form of private ownership. Contrast this, then, with the chronic state of affairs in France, where the bungling State policy has cast a heavy financial burden on subscribers, greatly impeded general development, and actually necessitated the maintenance of an abnormally high rate for some 10 years to prevent the rapid accession of subscribers which would have followed immediately on the reduction of rates to a more reasonable level.

In the author's opinion, free competition between telephone undertakings, though conducing to rapid initial development, is quite impossible as a permanent condition of working; ultimately it must give way to a State-licensed monopoly or to public ownership outright, and which of the latter is better depends upon local conditions—topographical and industrial—and upon national characteristics of temperament and mode of life.

Governmental control is no security against mistakes in policy, but it does, in a well organised State, enable the latter to be corrected as expeditiously as possible. The benefits of explicit State accountancy, liberal capital expenditure and consistent framing of policy to meet future as well as present needs, cannot be over-estimated.

Chapter VIII—considering what constitutes a "reasonable" rate under various conditions of cost and utility of service, number of subscribers and prevalent competition or monopoly—is specially valuable, and should assist many a harassed rate-designer; the latter is indeed an unfortunate individual, for, as the author drily remarks, "No system of rates can give universal satisfaction," and "Telephone users always consider all rates exorbitant!"

Two striking features of Continental telephone development are: (1) The important part played by telephony in the extension of rural telegraph facilities, and (2) the acute conflict between telephone and power circuit interests (especially in Germany in both cases).

As regards the general arrangement of the book—sectional headings within the various chapters are badly needed (those adopted in the list of contents would do admirably). To cite only one example, the general conclusions on pages 393-5 should certainly be separated from the sectional heading "Spain" under which they now appear. There is too great a tendency to "postpone judgment to a later chapter"; at least, some indication of the ultimate conclusions should be given after many of the lengthy considerations of facts and influences and, from one so much at home with his subject, we should have welcomed a greater number of general conclusions than are actually given.

Few books on telephone policy are free from bias, and the author of the present volume is to be congratulated on the vast amount of authentic and pertinent matter which he lays before his readers in such form as to enable its unprejudiced application to the particular circumstances of their own cases.—S. M. P.

BUSINESS NOTES.

Westinghouse Contracts.—Among important orders recently received by the BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., are the following:—

N.E.S. Co., for Bradbury, Williams & Co.—Three 157-KW. rotary converters, transformers and switchgear.

Tyneside Electric Development Co., Horden and Shotten Colliery.—Three 400-KVA. rotary converter sets.

John Summers & Co., Ltd.—One 500-KW. rotary converter and switchgear.

Greenock Corporation.—Two 450-KW. rotary converter sets, D.C. switchgear, &c.

Admiralty, Devonport.—Fourteen motors, 2½ to 40 H.P., 440-volt D.C., control gear and spares.

Sir Wm. Arrol & Co., for Admiralty, Portsmouth.—Eight motors, 5 to 50 H.P., 440-volt, type A, control gear and spares.

Cowans Sheldon, for Imperial Japanese Navy.—Three 60-H.P., one 25-H.P., 220-volt, 500-R.P.M. G motors, control gear and spares; three 60-H.P., one 25-H.P., 220-volt, 500-R.P.M. G motors, control gear and spares.

R. H. Barker & Co.—One 5, four 40, one 50, one 100-H.P., 440-volt, two-phase 60-per. A.C. motors and control gear.

Holders Brewery, Ltd.—Twelve motors, 1 to 35 H.P., 440-volt, three-phase 25-per. sq. cage, and starters, and one M.G. set, 440-volt A.C., to give 9 amps. at 110-volt D.C., and one 150 KVA., one 25-K.V.A, three-phase, 25-per. transformers and switchgears.

Wellman, Seaver & Head, Ltd.—Eleven motors, 5 H.P. to 100 H.P., 460-volt. Ransomes & Rapier, Ltd., for Admiralty, Devonport.—Eight motors, 2 H.P. to 20 H.P. 440-volt, control gear and spares.

B.A.G.S. Railway Co., Ltd.—Four 20-H.P., 440-volt, 1,450/1,500 R.P.M., three-phase, 50-per. 50 C.B., and starters, one 25, three 15, three 10, one 5-H.P., 550-volt, 950 R P.M. G motors and starters.

Cjers, Mills & Co., Ltd.—One Westinghouse-Rateau blower, to deliver 25,000 cb. ft. free air per minute against terminal pressure of 6½ to 8 lb. per sq. in., direct driven by 900 H.P. 3,000 R.P.M. single velocity wheel turbine.

Manchester Corporation.—Fifty magnetic brakes.

Blackburn Corporation.—One 2,000-KW. 3,000 R.P.M. A.C. turbo-generator set, with surface condensing plant, &c.

County Borough of Blackburn.—One 800-KW. rotary converter.

South Shield Corporation.—One 1,500-KW. high-pressure turbine (impulse type), coupled to one 1,000-KW. D.C. generator and one 1,100 A.C. generator in tandem with surface condensing plant, Lea recorder and Brown, Boveri regulator.

East Indian Railways Co.—Two 400-KW. D.C. turbo-generators, &c.

Strain & Robertson, for Alienza Co., Ltd., Oficinia.—One M.G. set, 13 motors, 200-volt, three-phase 50 per, main switchgear, control gear and spares.

J. Howden & Co.—One 1,000-KW. turbo type alternator.

Randfontein Mines.—One 265 and one 40-B.H.P. A.C. motors.

La Plata Trams.—Ten 200 T.C. equipments.

The Cremation of King Chulalonkorn.—We are informed by the GENERAL ELECTRIC CO., LTD., that the funeral rites for the late King Chulalonkorn were conducted in the light of Osram lamps, and that upwards of 100,000 C.P. of illumination was displayed. The Eastern agents of the G.E.C. state that the Siamese papers referred to the brightness of the scene as indescribable.

The Wholesale Hardware Club.—We have received a copy of the prospectus and list of members of this club, whose registered offices are at Royal London House, 14, Finsbury Square, E.C. Mr. Chas. Churchill is president, and Mr. Reginald Cooper secretary. Several firms in the electrical trade have representatives on the current year's honorary council. The booklet contains photographs of the president and past presidents, and officers, also of the rooms, a note of the charges, and the various departments in which the interests of the members are cared for. A form of application for membership is an appeal to other firms in the electrical trade to identify themselves with the club.

Book Notices.—*Handbook on Electroplating, Polishing, Lacquering, Burnishing and Enamelling.* Birmingham: W. Canning and Co. 1911.—This is the fourth edition of Messrs. Canning and Co.'s excellent handbook, which has been much improved in several of the sections. It is an essentially practical work, and though it applies especially to the apparatus made by the firm, the instructions given are of general application. Naturally, electricity dominates the work, and we are pleased to notice that apart from its employment for the deposition of metals, its immense advantages for motive power are recognised and insisted upon by the authors in preference to gas or steam power. Electrical practice in this branch of the industry differs widely from that to which we are accustomed in other directions, the currents used being so large and the pressures so small; consequently, the apparatus and methods employed are quite special, the latter being, in fact, largely empirical. This book, therefore, which embodies the fruit of long experience, should be found of great utility to all workers connected with the various arts named in the title. As often happens in books written by practical workers, its composition and diction are not always above criticism, but the wording is simple, and it is claimed with justice that the book can be read by the novice as well as by the expert.

The "M.C.C." Chart of the Elements. London: Metallic Compositions Co. Price 5s. (mounted on linen, 8s. 6d.).—This work is primarily intended as a guide to the metals, but also covers the non-metallic substances; it is based upon the Periodic Law, and shows the relationships existing between the various elements by means of a systematised classification and arrangement of them upon a large folding chart, the production of which must have involved a vast amount of labour. The chart, it is claimed, is of direct interest and utility to electrical engineers, the positions of the metals and other elements on the chart giving, by inspection, information as to their electrochemical behaviour; the chart thus enables an investigator to take a bird's-eye view, so to speak, of the properties of the metal he is dealing with in relation to the properties of other metals, and guides him at once to the correct processes to employ. Not only are the known properties of materials thus indicated, but also many properties which have not yet been definitely investigated can be inferred from the position of the element on the chart in relation to the positions of elements of which the properties are fully known; thus, for example, in conducting a research upon electric lamp filaments, the user can readily see what elements are likely to be worth trying, and what difficulties may be anticipated in dealing with them. An explanatory introduction is provided with the chart, to facilitate its use by those unversed in chemistry and unacquainted with the Periodic Law; in the second part of this booklet the author, inspired by his subject, treats of the relation of the Periodic Law to speculative thought and the problem of life. The work is decidedly interesting, and should prove very useful.

The Motor Boat Manual. London: Temple Press. Price 1s. 6d. net.—This is the fourth edition of a work compiled by the staff of *The Motor Boat and Marine Oil and Gas Engine;* it contains little of professional interest to electrical men, beyond a section on electrical ignition, which is very fully covered, all the usual devices and systems being well described and illustrated. Those, however, who are interested in the design and building of motor boats, and their management, will find in this manual a wealth of practical information. Unfortunately the electric launch is not included within its scope, though for smooth and silent running, and for pleasure purposes on inland waters—within range of charging stations—there is nothing to beat it.

Spons' Architects' and Builders' Pocket Price Book and Diary. 1911. Edited by C. Young and S. M. Brooks. London: E. & F. N. Spon. Price 2s. 8d. net each part.—This year, owing to important additions to the memoranda section, the work has been divided into two parts sold separately—the Memoranda Section, and the Prices Section, the latter being combined with a diary for pocket use. The former is arranged alphabetically, and contains notes and information of a general character, including an electrical section dealing briefly with electric lighting, heating and cooking, and a specification for a complete electric lighting installation. There are also in the Price-Book Section a few pages devoted to "Electrician," giving prices for work and materials in brief. As a rule the prices are on the high side, and although metal-filament lamps are dealt with, the particulars mainly apply to carbon lamps, whereas these should now be regarded as the exception and the tables made out for the former. There is a great deal of information in these two volumes that should be of direct utility to contractors and others who come in contact with building work, and they are most handy for the pocket.

We have received a copy of the first number of *Chemical Engineering and the Works Chemist*, a monthly shilling publication for chemical engineers, works chemists and chemical manufacturers. It is the official organ of the Association of Chemical Technologists, which was formed in March last, and is published at 144, Snargate Street, Dover. This number (May) contains articles on the following and other matters:—"Technical Chemistry and the Chemical Technologist," "The Status of the Working Chemist," "Crossley Ammonia-Recovery Gas Plant," "A Rapid Analysis of Phosphor Bronze," "Worthington Steel Cooling Towers and Condensers," "The Need for Reform in our System of Chemical Training."

"*Bulletin* de la Société Internationale des Electriciens." Vol. I, No. 6. June, 1911. Paris: Gauthier-Villars. Price 2 fr. 50 c.

"The Post Office Electrical Engineers' Journal." Vol. IV, Part 2. July, 1911. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. II, Part 4. May, 1911. Johannesburg: The Institute. Price 2s.

"The Design of Static Transformers." By H. M. Hobart. London: Constable & Co., Ltd. 1911. Price 6s. net.

"Illumination: Its Distribution and Measurement." By A. P. Trotter. London: Macmillan & Co., Ltd. 1911. Price 8s. 6d. net.

"Annales des Postes, Télégraphes et Téléphones." No. 4. June, 1911. Paris: A. Dumas. Price 7 fr.

The current number of the *I.C.S. Student* gives an account of the great "Festival of Empire" students' demonstration at the Crystal Palace on July 17th. Nearly 5,000 students took part in the function, at which Lord Desborough presided. The chairman expressed his deep interest in the work of the I.C.S., which he regarded as in no way prejudicial to that of the technical colleges, but on the contrary, as most beneficial to them and to the nation. Sir Joseph Ward, addressing the meeting, said that there were 160,000 I.C.S. students in the Empire—100,000 in Canada, 42,000 in the United Kingdom, 6,000 in India and the Crown Colonies, 7,000 in New Zealand and 5,000 in Australia. The Postmaster-General of the Commonwealth of Australia had urged his officers to join the I.C.S., and on his return to New Zealand he would do likewise, as he was firmly convinced of the value of their work. Mr. G. H. Roberts, M.P., also spoke at some length.

Catalogues and Lists. — THE ELECTRICAL POWER ENGINEERING CO., Stechford, near Birmingham.—Leaflet showing and giving prices of their dust-proof ball-bearing polishing motors of ¼, ½, 1 and 2 B.H.P., which they are just placing on the market.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Pamphlet No. 50 containing illustrations, brief particulars and prices of their 50-ampere watertight wall plugs, the design of which is in accordance with the Home Office regulations regarding the earthing of portable apparatus.

MR. JAMES HENDRY, 252, Main Street, Bridgeton, Glasgow.—Effective showcard representing one of the firm's new patent flexible laminated leather belts in use.

MESSRS. R. H. PATTERSON & CO., LTD., Forth Street Works, Newcastle-on-Tyne.—24-page catalogue of new and second-hand machinery for sale or hire.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C. — 4-page leaflet illustrating a number of artistic designs of window signs, intended to combine both a lighting and an advertisement fixture, which they are making up in their works in various metals and finishes according to requirements, also two typical examples of signs actually installed. The various methods of using the lamps and installing the signs are illustrated. New list of "Spookie" shades for candles, pendants, table lamps, &c. Several new designs are included. The firm have been appointed sole selling agents for these shades for Great Britain, Europe, British Empire and the Argentine. Contractors can have copies of the list printed with their own names and addresses.

MESSRS. FOSTER ENGINEERING CO., LTD., Morden Road, Wimbledon, S.W.—New leaflet illustrating and describing their electric furnace transformer and regulating transformers; also a copy of the latest edition of their "Foster" metal lamp list showing the various shapes in which these lamps are made. The manufactures are all produced at the Foster works at Wimbledon.

MESSRS. CARNEY & PEARN, LTD., Nutsford Vale Works, Longsight, Manchester.—List No. 102 containing a description, with tabulated sizes and prices, of their "C. & P." silent auto-transformers.

THE UNBREAKABLE PULLEY AND MILL-GEARING CO., LTD., West Gorton, Manchester.—20-page pamphlet containing numerous illustrations with description, tabulated sizes, prices and dimensions of the Benn patent friction clutch, and clutch actuating gears.

BAMBERGER INDUSTRIE - GESELLSCHAFT m.b.H., Bamberg, Bavaria.—Leaflet relating to fittings and accessories for wiring with conduit, Edison screw switchboard elements, &c.

MR. R. E. STEEL. 794, Salisbury House, London Wall, E.C.—Full list describing, and tabulating sizes, speeds, prices, &c., of, the Beedle patent electric ventilating fans for C.C. and A.C.; also a 4-page list dealing with the Beedle patent impellers for ventilating fans; and one describing distilling apparatus for producing pure distilled water for laboratories, storage battery installations, &c.

MESSRS. SCHIERSTEINER METALLWERK G.m.b.H., Berlin W. 57.—Leaflet relating to cyclometer parts for meters.

New Electrical Showroom.—On Friday last the Poplar B.C. Electricity Committee opened a new showroom at 121, East India Road, E. The premises, although not extensive, have been very effectively arranged. The exterior is illuminated by three metallic-filament lantern fittings, whilst the window contains a good display of ornamental fittings, radiators, fans, &c. The interior has been set out as an inquiry office, with a representative selection of pendant and wall fittings, radiators, fans, domestic appliances, &c., and an illuminated sign set in a niche announces a cheap power rate. A small room at the rear has been utilised as a kitchen with "Tricity" apparatus, the advantages of which, as compared with the gas or coal fire methods of cooking, were most admirably demonstrated by Mr. F. S. Grogan. We may remark, in passing, that periodical demonstrations will be given with this apparatus. Above the kitchen is a very tastefully decorated dining room, one side of which is open to the inquiry office, being separated therefrom by an open balustrade. This room contains a number of table, wall and pendant fittings. The Council, in opening the showroom, hopes to get into closer touch with every class of consumer, and we have no doubt that it will assist greatly in increasing both the day and night loads. With regard to contractors who may establish themselves in the borough, the undertaking will be in no way a competitor to them

Bankruptcy Proceedings.—THOMAS CHARLES FRANCIS, electrical engineer, Liverpool Road, Stoke-on-Trent.—At a meeting of the creditors on July 12th, accounts were presented showing gross liabilities amounting to £524 and unsecured liabilities totalling £513; assets, £11. Debtor, who attributes his failure to his expenses being in excess of his income, commenced business in 1904 with a borrowed capital of £400. Two years later he was joined by two partners, but a deed of assignment and dissolution followed. Debtor was in private employment from 1908 to 1910, when he again resumed business with only £10 capital. The estate remains in the hands of the Official Receiver for realisation.

EDWARD JAMES CROSIER (Crosier, Stephens & Co.), Newcastle-upon-Tyne.—Some particulars have already been published. At the Newcastle-upon-Tyne Bankruptcy Court on 13th inst., bankrupt came up for his first public examination. He said he started business in partnership in 1891 as an engineering agent and merchant. He gave particulars of his different partnerships and of surpluses and deficiencies in different years. He continued trading because several gentlemen offered to put money into the business, and apart from those offers, he thought he would recover his business by leaps and bounds. Nearly all his trade debts had accrued since 1908. He complained that his assistants were at one time disloyal, and that affected his business. In January, 1911, a company was formed, called the Cromil Engineering Co., Ltd., for the purpose of selling Cromil specialties. Debtor received 3,000 £1 shares, and was appointed manager at £6 per week. In reply to Mr. J. A. Dixon, debtor said that assistants had put into the business sums of money as loans, as a consideration for them learning debtor's business. In answer to Mr. R. E. B. Lisle, his solicitor, debtor said he had taken over new agencies to try and improve his business. The examination was adjourned.

ALFRED SITCH, metal worker and electrical engineer, 77, Brecknock Road, London.—Receiving order made July 10th on creditor's petition. First meeting, July 26th; public examination, September 5th—both at Carey Street, W.C.

W. H. RIDPATH (Ridpath & Wells), electrical engineer, Ilkeston.—Receiving order made on debtor's petition, July 14th.

W. H. ILLINGWORTH, electrical engineer, &c., Halifax and Leeds.—Last day for receipt of proofs for intended dividend, August 2nd. Trustee, W. Durrance, 12, Duke Street, Bradford.

Condensing Plant Contracts.—The following are among the orders for condensing plant which have recently been received by the MIRRLEES WATSON CO., LTD., of Glasgow:—

SURFACE CONDENSING PLANT—
Two sets for Stoke on-Trent Electricity Works, per Messrs. Jas. Howden and Co., Ltd.
Three condensers for Messrs. Gwynnes, Ltd.
Plant for the Torquay Corporation Electricity Works, per the British Thomson-Houston Co., Ltd.
A repeat order for the Govan Corporation, per Messrs. Jas. Howden and Co., Ltd.
Plant for Messrs. Bolckow Vaughan's Steel Works, South Bank (ninth set).

JET CONDENSING PLANT—
Plant for St. Croix.
Plant for Waleswood Colliery, per the British Thomson-Houston Co., Ltd.
Plant for St. Helens Corporation (repeat order).
Plant for Messrs. Bolckow Vaughan, Leasingthorne Colliery.
Plant for the Lancashire and Yorkshire Railway, Formby Power Station, per the British Thomson-Houston Co., Ltd.

Australia.—The Australian Customs authorities have lately given a decision to the effect that "Holders, brush, for dynamo-electric machines," are to be classified under No. 177*a* of the tariff, the duty being at the rate of 20 per cent. *ad valorem* on both British and foreign goods.

Annual Holidays.—THE GENERAL ELECTRIC CO., LTD., Witton, Birmingham, announce that their works will be closed from 12.30 p.m. on Saturday, August 5th, until 7.30 a.m. on Monday, August 14th, 1911, for the annual holidays. Goods will not be dispatched between these dates, but a small staff will attend to deal with matters of extreme urgency.

Sales Managers' Association.—The members of this Association were to meet yesterday (Thursday) evening, July 20th, at 6.45 p.m., at Holborn Restaurant, for their monthly business dinner and discussion. The first of a series of discussions on (1) Selecting and engaging salesmen, (2) Methods of training salesmen, (3) Managing salesmen, had been arranged for, the talk being opened by Mr. R. A. Learned, of the International Multigraph Co. We are asked to state that any business manager or sales manager who desires to attend the next meeting of the Sales Managers' Association, or who desires further particulars as to the aims and scope of the Association, is invited to communicate with any of the members mentioned above, or with the hon. secretary, Mr. F. R. Jones, Audrey House, Ely Place, E.C.

Preston Semi-Convertible Car.—THE UNITED ELECTRIC CAR CO., LTD., of Preston, Lancs., have sent us a copy of a pamphlet just issued by them, describing and giving a number of photographs of their Preston semi-convertible tramcar, as recently supplied to the Blackpool Corporation. The car combines their patent system of side windows, and an additional means of exit from the car. The side windows give a clear opening, when both windows are lowered, of 3 ft. 9½ in. A special feature of the body is the width over corner pillars of 7 ft. 6 in., which is a great advantage where cross seats are used, as it allows a comfortable seat for two passengers on each side of the gangway. The width of the gangway in the Blackpool car is 1 ft. 5 in. The seats are of the rattan spring reversible tilting type. The lighting of the car is by a neat four-light fitting in the centre, and four single-light fittings. The blinds are of a special leather cloth pattern, and the inside ventilation is of the latest Preston type. The length of the platforms is 6 ft., or 9 in. longer than the recognised standard, a special feature being a clear and wide entrance or exit under the staircase to facilitate loading and unloading at the end of a journey. The staircase is very wide and easy to descend or ascend, and it follows the sweep of the dash. On the upper deck the seats and backs are also of rattan, and the increased width of the car makes it very commodious. The side windows are of plate glass and without frames; they operate independently with the aid of lazy tongs. The car is mounted on the Preston patent flexible axle yoke type truck with a wheel base of 8 ft. 6 in. Some of the advantages claimed for this truck, a large number of which are now in operation, are its ease in negotiating sharp curves, long spring base, even wear on tires, and longer life for tires and axles. The seating accommodation of the car is 28 inside (lower saloon), 20 inside (upper saloon) and 18 under the canopies—66 in all. The semi-convertible type of car is regarded as the ideal car for seaside towns, and for all towns where there are pleasure routes running out into the country.

Trade Announcements.—MR. WILLIAM BRICKETT, for many years manager for Messrs. J. & G. Pearce, of 2, George Street, Richmond-on-Thames, who are giving up business, has commenced business as an electrician at 6, King Street, Richmond.

MESSRS. FREDERICK RYMAN & Co., manufacturing electrical engineers, ask us to state for our readers' information, and to save further delays of correspondence, that their correct address is 116 Livery Street, Birmingham (not Cox Street, St. Paul's Square).

"Stannos."—We are informed by MESSRS. SIEMENS BROS. & CO, LTD, Caxton House, Westminster, S.W., that, owing to increased manufacturing facilities and the reduced price of rubber, they have increased the discounts off the price of "Stannos" wire and fittings as from 17th inst. Particulars will be supplied on application.

Demand for Engineering Appliances in Canada.—Our contemporary, *Canada*, states that Mr. Leonard Andrews, M.I.C.E., managing director of the Key Engineering Co., London and Manchester, has recently returned from a business tour on behalf of his company through Canada, Australia, New Zealand and India. He tells us that he was particularly impressed by the demand for engineering appliances in all parts of Canada. Since his return to England, he has been urging British manufacturers to pay greater attention to this market, and he has been giving them such enthusiastic reports of the industrial developments of the country, and the consequent ever-increasing demand for engineering appliances of every description, that he has been commissioned by several of the largest engineering manufacturers in Great Britain to pay a further visit to Canada for the purpose of making fuller investigations as to the best means of catering for this demand. Mr. Andrews left Liverpool on Thursday, last week, and expects to be staying for a short time at the Windsor Hotel, Montreal, before leaving for the West.

Holiday Literature.—Other official publications, similar to those mentioned last week, have been received, dealing with the attractions of Swanage, Southwold, and Southend and Westcliff-on-Sea.

Dissolutions and Liquidations.—ACOUSTIC PATENTS, LTD.—A petition for winding up this company, presented by Siemens Bros. & Co., Ltd., creditors, is to be heard on July 25th.

BOMBAY HYDRO-ELECTRIC SYNDICATE, LTD.—This company is winding up voluntarily, with Mr. F. J. Horne, 214, Gresham House, E.C., as liquidator. A meeting of creditors is called for July 24th at 208, Gresham House. Creditors should send the usual particulars to the liquidator by August 14th.

W. M. RYAN & SON, electrical engineers, 2, Church Lane, Leytonstone, and 16 and 17, Devonshire Square, E.C.—Messrs. E. Ryan and G. Bristow have dissolved partnership. Mr. Ryan will attend to debts and continue the business.

BATLEY ELECTRIC CARBONISING CO., LTD.—This company is winding up voluntarily, with Mr. H. Appleyard, Prudential Buildings, Market Place, Dewsbury, as liquidator. A meeting of creditors is called for July 27th.

J. G. CHILDS & CO., LTD., Willesden Green.—First meetings of creditors and contributories, August 1st, at 11.30 a.m. and 12 noon, both at Carey Street, W.C.

The Aluminium Industry.—As previously mentioned in this journal, attempts have been made since the collapse of the former international aluminium syndicate, to bring about a fresh understanding, the efforts being put forth first by one group of interests, and then by another, but all endeavours to arrive at a world convention have been in vain. The only result has been a combination of the French producers, who transferred their production to the Frankfort Metal Co. The negotiations for a new international understanding have never been formally broken off, but have often remained at a complete standstill. It is now stated that discussion has recently taken place in order to prepare for a new agreement of an international character.

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LIGHTING and POWER NOTES.

Aberystwyth.—The T.C. has decided, by 7 votes to 4, to support the Bill being promoted to give powers to local authorities to sell electrical fittings and undertake wiring work.

Altrincham.—A conference of local authorities is to be held to discuss the proposal of the Altrincham Electric Supply Co. to apply for an order to extend its authority to the Bucklow area and the Hale urban districts.

Australia.—The annual returns of the Melbourne Electricity Department show a gross revenue (to February 28th) of £120,363, as compared with £113,579 in the previous year. The gross profit was £63,934, and the net balance, after meeting interest and sinking fund and depreciation charges, £19,532. The Council is to install a large battery in a central site at an estimated cost of £21,000. The total units sold during the year were nearly 9,000,000, power and heating accounting for one-third.

Early in June a 1,500-KW. turbo-alternator at the Richmond works of the Melbourne Electric Supply Co. broke down, and a second 1,000-KW. machine also failed when called upon. As a result, many factories had to cease work, and some of the street lighting was affected, until the Melbourne City Council came to the company's aid with an emergency supply. The company had a new 2,000-KW. machine on order, which should have been delivered from England before the mishap.

Ardsley.—The Council has consented to the Electrical Distribution of Yorkshire, Ltd., applying for a prov. order to supply the township.

Batley.—The B. of T. has communicated its decision in reference to the dispute between the Corporation and the Yorkshire Electric Power Co. The Board states that the company shall be allowed to extend its mains from Thornhill to Pudsey *viâ* Mirfield and Spen Valley, and for that purpose to lay its cable under Bradford Road, a course to which the Corporation raised strong objection. The condition is imposed, however, that the work must be carried out within 12 months.

Barnsley.—A prov. order for E.L. in the area of the R.D.C. is being applied for by the Yorkshire Power Co.

Biddulph.—Mr. Robert Heath has laid before the ratepayers an E.L. scheme for the town, the idea being for the U.D.C. to take current in bulk from Messrs. Heath, who are bringing electric power from Kidsgrove to Black Bull. The firm offer current to the Council at 1½d. per unit. At present gas is supplied at 3s. 8d. per 1,000 cb. ft. The matter is to be dealt with by the Council.

Buckingham.—The T.C. has accepted the tender of the E.L. Co. for street lighting for five years at £140 per annum.

Canada.—The Ontario Government claims the right to power developed from Dominion canals, and proposes to press for compensation to the extent of $100,000 a year. The Ontario Government, while admitting the possibility of Federal authority to take water from lakes and streams for navigation purposes, insists that any power incidentally developed by the construction of dams shall remain under Provincial jurisdiction. Therefore, while the Dominion may construct the works necessary for navigation purposes, it is not entitled to any revenue from any water-power that may have been even temporarily developed.

The plant of the Canadian Light and Power Co., at St. Timothé and Valleyfield, Que., is nearing completion. Three wheels and one generator are installed, and construction on the intake and the tail-race is about completed. The immediate supply of power will be 21,600 H.P., the contemplated output being 75,000 H.P., which is expected to be available for transmission by next fall to Montreal. The company has already disposed of all the power that will be available for the next few months.

Carlisle.—A net profit of £3,346 has been made on the Corporation's electricity undertaking during the past year.

Continental Notes.—AUSTRIA.—Plans are being prepared in respect of a projected electricity generating station near Pettau, utilising the water-power of the River Drau. It is estimated that about 34,000 H.P. is available. The Siemens-Schuckert Co., of Vienna, and the Ganz Co., of Budapesth, are interested in the scheme.

FRANCE.—La Société Electrique de la Vallee de l'Yonne is the name of a new company which has just been formed at Pont-sur-Yonne, with a capital of £18,000, to establish a small electric lighting station in the town.

GERMANY.—The A.E.G. is in negotiation with the municipal authorities of Altona with reference to taking over the electric lighting station and undertaking in the town. It is proposed to form a separate company, with a capital of £325,000, to carry on the undertaking, in which the municipality will take shares to the value of £175,000.

SPAIN.—The municipal authorities of San Juan de la Abadese (Province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Clayton.—A prov. order for E.L. is being applied for by the Electrical Distribution of Yorkshire, Ltd.

Doncaster.—On July 12th a L.G.B. inquiry was held into the application of the T.C. for a loan of £12,000 for electricity purposes, a portion being for excess expenditure. The other items were: Boiler, £940; new offices, £638; fan, £163; alteration to flue, £150; 500-KW. turbo-generator, £3,900; alterations to bunkers and coal-handling plant, £1,200; mains, services and meters, £2,350; switchboards, &c., £250; foundations, £155; feed-water heaters, softener tanks and alterations, £355. There was no opposition, but the inspector (Mr. T. C. Ekin), referring to the excess expenditure, intimated that the Council would probably receive a strong letter from the L.G.B.

Douglas (Isle of Man).—On the 12th inst. the T.C. received a memorial from tradesmen asking that electric light should be provided by the borough, and a special Committee of the Council was appointed to report on the question of the feasibility of establishing an electric light undertaking.

Durham.—For installation at one of the pits of the Consett Iron Co., Messrs. Ernest Scott & Mountain have in hand two of their latest type of centrifugal pumps, each pump being of the seven-stage type and arranged to deliver 250 gallons per minute against a total head of 445 ft., and to be driven by a three-phase 625-volt, 50-cycle squirrel-cage motor. The same firm has recently completed at the Eldon Colliery of Messrs. Pease & Partners, a double-drum main haulage gear of 150 to 250 H.P. capacity, fitted with drums 4 ft. diameter by 2 ft. wide, and 5 ft. 8 in. diameter over shield-boards. There is also a main and tail-haulage gear of 200 to 400 H.P. capacity fitted with drums 5 ft. diameter by 2 ft. 6 in. wide, and 7 ft. 6 in. diameter over shield-boards. This gear is driven by means of a three-phase motor working on 2,750 volts, 40 cycles, the motor driving the gear through a single reduction of machine-cut helical gearing.

For one of the pits of the Lambton Collieries they are supplying two three-throw pumps, delivering 400 gallons against a total head of 700 ft., and driven from the motor through gearing.

Ealing.—The charge for electric current for power, heating and cooking has been reduced to 1d. per unit.

Eccles.—The new weaving shed of the Eccles Industrial Manufacturing Society, Ltd., is now completed. The looms and preparation machinery are driven by single motors, and, according to a textile correspondent, the new system of driving is giving every satisfaction. The motors are by the Schorch Electrical Co.

Epsom.—The U.D.C. has decided to supply current for lighting the premises of the Conservative Club, for £30 per annum.

Guisborough.—The U.D.C. has been served with a petition from over 400 residents expressing the opinion that the time has arrived for steps to be taken to obtain an electric supply for the town. A special meeting of the Council is to be held to consider the matter.

Hastings.—After years of deficits it is satisfactory to note that there now seems every promise that the Corporation electric lighting undertaking is on the road towards prosperity. At a L.G.B. inquiry a few days ago into an application for the borrowing of money for extension of mains, the Inspector expressed satisfaction that the undertaking had "turned the corner," and added: "You appear to be wiping out liabilities at the rate of £1,000 or more a year." The electricity department, in common with the other municipal departments, has just undergone an inquiry by a special committee, which has this week presented a report highly complimentary to the electrical engineer (Mr. Russell Ferguson).

Ilford.—The U.D.C. has received the sanction of the L.G.B. to a loan of £8,070 for mains, meters, switchboard, &c.

Leigh (Lancs.).—The extension of the electricity undertaking formed the subject of a L.G.B. inquiry by Mr. T. C. Ekin, on July 13th, in connection with a loan of £5,300. It was stated by Mr. A. T. Smith (borough electrical engineer) that the existing plant was capable of an output of 760 KW., not taking into account the accumulators, which were capable of supplying 220 KW. for one hour. The present consumption stood at a maximum of 500 KW., and additional applications had been received by the Corporation for lighting and power, which would give a maximum load of 600 KW. In order to meet this demand it was proposed to put in a 500-KW. set, with a condenser capable of dealing with 1,600 KW., and additions to switchboards and buildings. Included in the £5,300 were the following amounts:—£2,310 for engine and dynamo; £1,926 for condenser; £163 for switchboard; £115 for steelwork; £889 for buildings and foundations; and £104 for alterations to engine room. There was no opposition to the scheme.

Luton.—A L.G.B. inquiry was held on July 11th into the application of the T.C. for a loan of £13,497 for electricity purposes. There was no opposition.

Portishead.—The Bristol T.C. having arranged terms, has withdrawn its objection to the granting of the Portishead E.L. order. The promoters agree not to give a supply of current within the city area without the Council's consent; not to erect overhead wires in roads in Portishead where the Council is inter-

ested as owners, but to lay compulsory mains in such roads, while the Council is to have the power to purchase any portion of the undertaking which is in future included in the city boundary. The area of supply contemplated is Portishead, Portbury, Easton-in-Gordano, North Weston and Abbot's Leigh, Flax Bourton, Long Ashton and neighbouring parishes.

Ramsbottom.—The U.D.C. has asked the Lancashire Electric Power Co. to quote terms for public lighting at Summerseat.

Rishton (near Blackburn).—Mr. J. W. Speight, of St. Anne's-on-Sea, has notified the U.D.C. of his intention to apply to the B. of T. on behalf of a new company, to be called "The Rishton Electrical Supply Co., Ltd.," for a provisional order for the urban district.

Rugeley.—The U.D.C. has decided to consider the question of lighting the town by electricity, presumably with a view to the Council applying for a prov. order.

Sheerness.—The U.D.C. has sealed an agreement with the Electric Power and Traction Co., Ltd., for lighting by electricity West Street, High Street, Broadway, Edward Street and Marine Parade. A year is to be allowed to carry out the work.

South Africa.—CAPE TOWN.—The illuminations in connection with the local celebration of the Coronation were both pretty and effective. Although the Government buildings were not nearly so extensively illuminated as on the occasion of the opening of the Union Parliament by the Duke of Connaught and the street illuminations did not have the imposing outlines of the triumphal arches, yet the simpler festoons of lamps along the principal streets and the outlining of the chief business places, had a very pleasing effect, and were very generally admired. Free current was given by the Corporation for the night of the Coronation, and this was taken full advantage of. The load on the Corporation supply was on that evening nearly 1,500 KW.

OUDTSHOOM.—A movement is on foot for the acquisition of the electric light undertaking of the local company, as a municipal concern.

Southport.—The T.C. has applied to the L.G.B. for a loan of £1,500 to meet the cost of a duplicate cable to the sewage works at Crossens.

Sunderland.—At a meeting of the T.C. on July 13th, when the annual report of the Electricity Committee was moved, Mr. Hartley French moved an amendment that an item of £12,402 set down as interest on mortgage debt should be so altered as to show that £404 of this was interest on bank overdraft.—Mr. G. S. Lawson seconded, and said that bank charges for overdraft were quite illegal, and after the West Ham and Tottenham decisions in Court, he protested against such charges being put into the accounts of the Committee in an underhand way.—Mr. F. Nicholson pointed out that the amount of the bank overdraft was plainly set out in the balance-sheet immediately below the accounts.—The amendment was lost, and the report, after discussion, carried.

Swinton and Pendlebury.—A letter has been received by the local D.C. from the Lancashire Electric Power Co. concerning the proposed supply of electricity to the Broad Oak Park area. Mr. T. L. Miller, electrical engineer, has been engaged to report on the proposals.

Truro.—Messrs. J. W. Purves & Co., of Exeter, have informed the T.C. that they intend applying for a prov. order for E.L.

Wakefield.—The T.C. has applied to the L.G.B. for a loan of £5,540 for mains, sub-stations and transformers.

Weymouth.—The electricity undertaking of the T.C., which some years ago was the subject of a searching L.G.B. inquiry, has turned the corner, and at the last meeting of the Council, the Electricity Committee was able to report a remarkable year's progress. There was an increase of 3,636 lamp connections during the year, and the gross receipts amounted to £7,011, and the gross expenditure to £3,133, leaving a gross profit of £3,877, which, after paying interest on loans and repayment of moneys borrowed, means a profit on the year's working of £387. There were more new consumers during the past 12 months than in the whole of the three preceding years, and the actual commercial result of the year's work would enable a company to pay a dividend of 5 per cent., and place £1,200 to reserve.

Whitworth.—The U.D.C. has applied to the B. of T. for an extension of time for carrying out the E.L. order.

Winchcombe.—The R.D.C. has assented to the application of the Cheltenham T.C. for a prov. order for E.L. in the rural district.

Wombwell (Yorks.).—A special meeting of the Council has been held to reconsider the application of the Electrical Distribution of Yorkshire, Ltd., for a prov. order. The clerk was instructed to ask for an interview with the company, and to promise that there would be no opposition to the application if provision was made for necessary protective clauses.

TRAMWAY and RAILWAY NOTES.

Australia.—The Tasmanian Parliament last session discussed a proposal to lay an electric railway line from Hobart to Huon, the power to be supplied by the Complex Ores, Ltd. The Parliamentary Committee estimated that the line would open up an area of approximately 100,000 acres of Crown land suitable for settlement. The estimated cost of construction was £223,000, the estimated expenditure per annum £19,362 (including interest), and the revenue £26,280. A steady growth of 5 to 10 per cent. on these figures, it was thought, might be expected. Arrangements have been made for Mr. W. G. T. Goodman to report on the scheme. —*Engineering and Electrical Record.*

According to the *Australian Mining Standard*, the Hobart Municipal Council recently deferred consideration of a report on the purchase of the Hobart electric tramways pending the return of the manager.

The same paper prints a report of the Railways Standing Committee of the Victorian Parliament on the proposed duplication of the Caulfield and Camberwell suburban railways. The Committee considers that the £650,000 required for this work would be better expended in the electrification of these routes, and certain others, a matter of 50 miles. A much improved service could be given and more effective competition with the suburban tramways provided.

If the electrification of these lines is not sanctioned, the Committee says it will be necessary to regrade and duplicate them for steam haulage, at a cost of £964,000.

The president of the Australian Tramways Association, after a recent tour in Australia, gave it as his opinion that grave discontent exists among the tramway employés all over the States, and that the employés would strike immediately, if the executive would sanction it.

Birmingham.—According to the *Financier*, the Tramway Committee has decided to recommend the immediate acquisition by the Corporation of the whole lines now within the greater Birmingham area, leased to the British Electric Traction Co., represented locally by the City of Birmingham Tramway Co. The proposed expenditure is £151,000, which includes the purchase of a number of power stations. It is unlikely that the negotiations will be completed before the end of the year.

Cheshire.—Arising out of a letter which Messrs. Forwood & Williams forwarded to the Neston and Parkgate U.D.C., Cheshire, the Council passed the following resolution at its last meeting :—"That this Council is of opinion that an improved railway service would expedite the development of the district, and they urge the Joint Railway Co. to double and electrify the Hooton and West Kirby line, so as to obviate the constant delays of through trains to Hooton."

Continental Notes.—GERMANY.—A noteworthy agreement of a provisional character has just been concluded between the Berlin City Council, on the one hand, and the Grand Berlin Tramways Co., on the other, including the company's four subsidiaries in the West, the South, the North-East and the Berlin-Charlottenburg tramways. The agreement will put an end to all uncertainty or indistinct legal relations between the two parties, and whilst giving the city the power to supervise the undertaking, it will also enable the company to develop the system on a clear financial basis. In the first place, the city prolongs until 1939 its consent, which now runs to 1919, and has the option of further extending it until 1949, but the company cannot independently propose a prolongation of the working concession granted by the State until 1949, the latter problem having hitherto been a source of dispute between the company and the city. The company agrees to pay the sum of £1,150,000 to the city at once, in return for the latter abandoning its right to take over the tramway tracks in 1919, and a meeting of the shareholders has been convened to sanction this payment and other portions of the scheme. A financial control is accorded in so far that the city will have the right of appointing three representatives on the board of directors, and its sanction will be required to any alterations in the company's statutes in respect of the amount of the share capital, the distribution of the profits, the reserves in redemption or renewal funds, &c. In this way the city desires to protect itself against watering of capital, to safeguard its share in the profits and to prevent the forcing up of dividends at the expense of renewal funds, &c. The company receives 17 additional rights to use streets, and both parties grant the joint use of a number of tracks, whilst the company abandons its claims for compensation on the ground of damages caused by the competition of certain municipal tramways. In return the company secures a monopoly in various parts of the city; has to increase the services at the request of the city, and has to construct new lines in the suburbs. If these lines are worked at a loss, the deficiency is to be borne by the city, which is, however, to be recouped out of subsequent surpluses yielded by these particular extensions. The agreement also provides for a revision of the fares every ten years, and for a conditional augmentation in the city's share in the company's net profits. It likewise contains details of the right of acquisition by the city at various periods during the term of the extended concession, whilst, if the undertaking is not taken over before 1949, the tracks and buildings will then pass into the possession of the city without any payment, only the rolling stock and sites being purchased according to the book value or on the basis of the estimated value.

SWEDEN.—The power station at the Porjus Falls is of exceptional importance as illustrating the water power-policy of the Swedish

Government. It is situated in the north of the country, and is intended partly for the working of the Ogoten railway, which leads from the iron ore region of Kiruna to the frontier, and is thence continued to Narvik, which is the most northern ice-free port in the world. The station is also for the purpose of providing power in connection with the working of the iron ore mines of Kiruna and Gellivare. According to Otto Kahn, the Porjus station possesses noteworthy peculiarities, as the engine room is built 166 ft. below the surface in consequence of the extreme cold, and the supply and discharge conduits also pass underground, and thus prevent the water from freezing. The engine room is artificially ventilated and lighted, and the switchboard apparatus and transformers are arranged in a special building on the surface, whence the machines are controlled by means of cables which are carried in a tunnel to the underground machinery room. The railway line from Gellivare to the Porjus Falls, which is to make this Polar power station accessible, is of importance from another point of view, inasmuch as it forms the first link in the great inland railway which is to proceed from Sveg, the most northern point of the railway network in Dalarne, to Gellivare and Porjus, a distance of over 400 miles. This scheme is connected with the water-power policy of the State, and the working of the railway by electricity is held in prospect. The electric locomotives for the Lapland railway are being supplied by the Siemens-Schuckert Works, whilst the A.E.G. is carrying out the electrical equipment for the Rjukan railway in Norway.

ITALY.—The Rome municipality is to consider a scheme for the construction of an underground electric railway in the Eternal City, embodying the best features of such lines already in existence in London and Paris.

Dunfermline.—The T.C. has withdrawn its opposition to the application of the Dunfermline and District Tramway Co. for an extension of time under its provisional order, which expires this year. At a previous meeting the Council decided to oppose the application because of the failure of the company to run cars to the Milesmark district of the burgh. The extension of time is being limited to two in place of four years.

Dundee.—The local Trades Council is determined to have the question of the recent revision of the car fares opened up. The members have unanimously agreed to forward to the town clerk a resolution protesting against the action of the tramway convener in refusing to hear a deputation on the question of the abolition of workmen's cars, and as to the "absurd" alteration on the halfpenny stages. The electors are also being urged to make the matter a "burning question" at the next election.

London. — The report of the East London Railway directors states that, owing to unavoidable delay, the lessee companies have been unable to arrive at a final decision as to electrification in time for the report; it is hoped that a statement may be made at the meeting.

Manchester.—The *Financial Times* says, in regard to to the Manchester South Junction and Altrincham Railway, which has recently been the subject of considerable discussion owing to the rumour that the railway was to be electrified, as a preliminary, if successful, of a comprehensive scheme of electrification on the North-Western and Great Central local lines in the Manchester district, that no actual decision has yet been arrived at in the matter, which is, however, still pending, and has by no means been abandoned. Should electric traction eventually be introduced, the railways entering Manchester will be provided with a most valuable object-lesson as to the adaptability or otherwise of electrical operation in that congested district. The M.S.J. and A. Railway is a joint undertaking, owned by the London and North-Western and Great Central Companies.

Milnrow.—The U.D.C. has authorised the Rochdale Tramways Committee to act as its agents in the placing of the contract for the cars required to work the Milnrow tramways.

Oxenhope (near Keighley).—The U.D.C. has received a communication from the Keighley Corporation intimating that it is the intention of the latter to seek Parliamentary powers to run motor-'buses and railless trolley vehicles within the Council's area, and asking for the formal consent of the local authority. The Council decided that it was favourably disposed towards giving the necessary consent, but before doing so the Corporation is to be requested to supply further details.

Panama.—According to *Electric Traction Weekly*, Mr. C. G. Young is investigating the practicability of building an electric railway system in the city of Panama and its suburbs, including Balboa. Mr. Young represents a syndicate of New York capitalists, which expects to take over the interests of Mr. Cook, who has a franchise for a street railway in Panama, providing the transfer can be made, and a few minor concessions secured from the City Council to carry out the project on an enlarged scale. Mr. Young is at present consulting engineer in the construction of 150 miles of railroad in Hayti. He will have charge of the Panama system.

Sunderland.—At a meeting of the T.C. on the 12th inst., Councillor New, in moving the adoption of the annual report on the tramways, said the reserves and renewals accounts now stood at £25,324. In his opinion, it should be maintained at £30,000 for some years to come. The cars were in as good, if not a better, condition than when purchased, and 15 top covers had been added and paid for out of revenue.

U.S.A.—The Piedmont and Northern Railway, a subsidiary company of the Southern Power Co., Charlotte, North Carolina, has ordered from the Westinghouse Electric and Manufacturing Co. all the sub-station and car and locomotive equipment for its 125-mile interurban line, which will be operated with direct current at 1,500 volts. The aggregate cost of the equipments ordered is approximately $400,000. It includes ten 500-KW. motor-generator sets for the sub-stations, 23 quadruple 90-H.P. car equipments, and 14 55-ton electric locomotives, which will be used for hauling freight trains. This new line, which is now under construction, will connect Charlotte and King's Mountain, North Carolina, and Spartanburg and Greenwood, South Carolina. It will have some long steep grades, but each of the locomotives is to be of sufficient capacity to haul a train of 800 tons, and will be equipped with four interpole motors geared to the axles.

Electrification of the Broad Street terminal line of the Pennsylvania Railroad in Philadelphia is contemplated, according to Press reports. It is proposed that all trains drawn by steam locomotives shall start from the West Philadelphia station where through trains now stop without going into Broad Street. The station at Broad Street will thus become a terminus for a heavy suburban traffic with trains operated chiefly on the multiple-unit system.—*Railway Electrical Engineer.*

The Electric Storage Battery Co., of Philadelphia, has closed a contract for the battery equipment of the 35 new storage battery cars for the Dry Dock, East Broadway and Battery Railroad Co., of New York City, to be placed in service on its lines during the summer. These new cars have been specially designed by the Third Avenue Railway Co.; each car is equipped with two motors, and the batteries are installed under the longitudinal seats. The cars will give a maximum speed of 15 miles an hour on level track, with a schedule speed of 7 to 8 miles an hour, including stops. The battery equipment of each car consists of 58 cells of the "Hycap-Exide" type.

Warrington.—With reference to the renewal of tramway equipment, the tramways manager reported to a meeting of the Electricity and Tramways Committee as follows:—"I estimate the cost of providing new rails, &c., and relaying the track will work out at £3,000 per mile of single track. This means that £200 a year per mile on 8 miles of track should be added to our renewal fund, a total of £1,600 per year." It is understood that the Corporation will accept the report.

Wolverhampton.—The Corporation Tramways Committee has issued an abstract of the accounts of the undertaking for the year ended March 31st. The abstract shows that the gross profit was £20,811, and the net balance of profit has been appropriated for renewals £4,118, reserve £2,022, and to the borough rate £2,125. The sum of £38,454 now stands to the credit of the reserve and renewals fund. The traffic receipts for the year have increased by £4,152, consequent upon having a full year's operation of the Penn Fields section, the last to be opened, and also the extra traffic obtained during the aviation meeting in June and the Charity Carnival in August. The working expenses show a reduction of ·268d. per car-mile, the figure this year being 6·155d., as against last year's figure of 6·423d. per car-mile.

York.—The City Council has approved in Committee proposals for tramway extensions involving a total expenditure of nearly £42,000.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Special Commissioner who is testing the Sydney telephone service has apparently found it in a very inefficient condition, for out of 19 calls, 14 were badly served. Delays ranging from two to six minutes were experienced, and almost always there was a lack of supervision at the exchange to see whether he had got through to the called subscriber.

India.—In the annual statement issued from the India Office, it is stated that the telegraph system under the direct control of the Indian Government consists of 72,420 miles of line, 283,374 miles of wire and 327 miles of cable. The principal event of the past year was the promulgation of a scheme for the reorganisation of the upper ranks of the Indian telegraph department, under which the rates of pay of the various grades were considerably improved. A table is given, showing for a period of five years the progress that has been made in extending public telegraphic communication in the Empire. From this it appears that up to the beginning of the year 1905-6 the capital expenditure amounted to £5,824,031; the miles of line to 61,684, the miles of wire to 227,436, the miles of cable to 245, and the total number of offices open to the public to 5,986. At the end of the year 1909-10 the corresponding figures were—capital expenditure £7,264,674, miles of line 72,420, miles of wire 283,374, miles of cable 327 and telegraph offices 7,225. The number of messages in the year 1905-6 was 10,461,117, with gross receipts of £805,748, and net receipts of £206,696, showing a return of 3·33 per cent. on the capital employed. In the year 1909-10 the messages had increased to 12,084,697, but the gross receipts had fallen to £795,828, which was not sufficient to cover even the working expenses, and there was a charge on Government revenues of £179,646. The gross receipts fell short of those for any year since 1904-5. This was due almost entirely to a reduction in inland message revenue, both private and State, consequent on general depression in internal trade. Working expenses, on the other hand, continue to increase. In 1909-10 they exceeded those of the previous year by £24,497, due

chiefly to an increase of expenditure consequent on the reorganisation of the establishment of that branch, and to the introduction of the new time-scale of pay for superintendents and assistant superintendents with effect from December, 1909. The number of telegrams decreased during the year by 7·11 per cent., and their value by 11·65 per cent. The subscriptions to the telegraph department for telephone and similar services rendered during 1909 amounted to £32,592, being an increase of £5,462 over the figures of the previous year. The average annual subscriptions for the past five years amounted to £22,946. Numerous interruptions occurred during the year on the lines to foreign countries, notably on the Turkish and Teheran routes to Europe and on the Moulmein-Bangkok and Raheng lines to Siam. New wireless telegraph stations were opened at Bombay and Jask during the year, that at the latter place being subsequently handed over to the Indo-European Telegraph Department.

Japan.—In view of the increasing use of long-distance telephones, the Japanese Department of Communications is considering the question of erecting additional lines between Tokio, Yokohama, Nagoza, and Osaka, and also between Osaka Kyoto and Kobe. It is proposed to lay the new lines underground instead of overhead as hitherto.

Registration of Telephone Calls.—Mr. Crawshay-Williams asked the Postmaster-General whether the registration of calls on the telephone exchanges is absolutely automatic, or whether such calls are recorded by the operators, and what guarantee subscribers have as to the correctness of the number of calls registered.—Mr. Herbert Samuel replied that in the large Post Office exchanges where the calls are registered by means of meters connected with the subscribers' lines on central-battery switchboards, no call can be registered on any line unless it is connected with another line. The registration is not entirely automatic, as it does not take place unless the operator presses a key which controls the meter. The objection to an entirely automatic register is that it would not distinguish between calls which results in effective conversations and those which are ineffective, and should therefore not be charged for. Meters of the same forms as those in use by the Post Office are in general use in all the large exchanges in the United States, and the results are considered satisfactory. He is obtaining samples of a device which will register all calls automatically, but will allow the cancellation of ineffective calls, the subscriber being informed of the cancellation at the same time, and if this apparatus proves satisfactory it may be possible to allow subscribers the option of having it fixed on their lines at the small extra cost involved by its use.

The Telephone Service.—In reply to a suggestion put forward by the Liverpool Cotton Association that an advisory committee should be constituted of representatives of the Chambers of Commerce of the 10 largest cities of the Kingdom, to advise the Government as to the general working of the telephone and telegraph systems, particularly as regards rates, &c., the Postmaster-General pointed out the disadvantages and inadequacy of such a system, and stated that it was his intention to decentralise the administration of the telephone service, entrusting responsible officers in different parts of the Kingdom with a considerable measure of executive control. It would be the duty of these officers to keep in touch with commercial bodies and with local authorities in their provinces and districts, and it would therefore always be possible to secure free discussion between representatives of the Post Office telephone service and the bodies who might require special developments of the service to meet their needs.

The Corporation of the City of London has resolved to hold a conference at the Guildhall of representatives of local authorities in the London telephone area in regard to the acquisition by the Government of the National Telephone Co.'s undertaking, and for the consideration of the steps to be taken to obtain a cheaper telephone service.

The Telephone Transfer.—On the Telephone Transfer Bill coming up for second reading in the House of Commons on Friday last, all objections were withdrawn, in view of the settlement arrived at between the Postmaster-General and the company's staff. Mr. Herbert Samuel explained that the company appeared to have supposed that he desired to vary the terms of the agreement of 1905, but this was never his intention, and the wording of the Bill had been amended so as to leave no room for doubt that the Bill tallied with the agreement. Most of the points under discussion with the staff had been satisfactorily settled; as regarded the 12 senior officers receiving salaries of over £700 a year, he hoped to bring some of them into the Post Office; the services of five were required by the company, and some others having nearly attained the age of 60, the ordinary age of retirement of civil servants, it was not desirable to take them over. There was nothing in the Bill to prejudice the position of municipalities which might desire to undertake telephone systems in the future, though his own views and expert opinion generally were adverse to municipal telephony. In reply to a question, he was unable to consent to any concession with regard to payment to local authorities for wayleaves, which the Post Office was entitled to without payment. It was stated that the House would have ample opportunity to discuss the amount to be paid to the company for its plant; it had already been decided that the question should be referred to the arbitrators. The Bill was read a second time.

Wireless Telegraphy.—Permission has been given by the Postal Department to the Australian Wireless, Ltd., to establish a station in Melbourne.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—VICTORIA.—August 15th. 80,000 insulators, and india-rubber-covered wire, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 8th. Measuring instruments, telephone instruments and parts, and 25 trembling bells, 8-in. gong, for the P.M.G.'s Department. See "Official Notices" July 7th.

August 9th.—530 A.C. meters, 496 D.C. meters and 133 maximum demand indicators, for the Melbourne City Council. See "Official Notices" to-day.

SOUTH AUSTRALIA. — August 9th. (*a*) Letter-box fronts; (*b*) four petrol motor cars, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 23rd.—Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

NEW SOUTH WALES.—August 9th. P.M.G. Letter-box fronts. See "Official Notices" July 7th.

August 8th.—According to an Australian exchangge tenders are invited for electrical generators, storage batteries, and voltmeter, for the Stores Supply Department, 15, Young Street, Sydney. A. Berckelman, executive member.

QUEENSLAND.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 16th. — Cable, conduits, cast-iron pipes, iron poles, insulators, wire, &c., for the P.M.G.'s Department. See "Official Notices" July 7th.

TASMANIA.—July 31st. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

WESTERN AUSTRALIA.—August 2nd. Telegraph and telephone material for the P.M.G.'s Departemnt. See "Official Notices" July 7th.

Austria.—August 1st. The Austrian State Railway authorities at Stanislau are inviting tenders for the supply of five continuous-current electric motors for the railway works at that place.

Birmingham.—July 22nd. The Guardians are inviting tenders for the annual maintenance and renewals of the telephone system at the Dudley Road Infirmary. Master, Mr. T. M. Hardie.

Blackburn.—July 25th. Installation of a 28-point fire alarm, open-circuit system, for the workhouse. C. E. Bygrave, Union clerk, Union Offices, Cardwell Place, Blackburn.

Bradford.—July 25th. Two water-tube boilers, stokers and superheaters, and one 12-ton electrically-operated overhead travelling crane, for the Corporation. See "Official Notices" July 14th.

Brazil.—August 21st. Electric goods lift and electric crane for the Naval depôt on the Island of Cobras. Local repesentation. Deposit £33. Inspectoria de Engenharia Naval, Ministerio da Marinha, Rio de Janeiro.—*Board of Trade Journal.*

September 25th.—All electric lighting fittings, fans, lamps, insulated conductors, &c., required in connection with the equipment of the new Postal Telegraph building in Port Alegre with electric light. Value about £3,100. Local representation. Deposit about £33. "Directoria Geral do Expediente, Ministerio da Viacão e Obras Publicas," Rio de Janeiro.—*Board of Trade Journal.*

Canada.—August 10th. According to the *Canadian Engineer* tenders are invited in connection with the municipal installation at Penticton, B.C., for two 100-K.V.A. three-phase, 4,600-volt, 900 R.P.M., A.C. generators direct connected to impulse wheels operating at 2,045 ft. effective head, pressure pipe line of about one mile of 10-in. and one mile of 12-in. pipe, switchboards, transformers, meters, distribution and street lighting system. Specifications to be seen at:—F. H. Latimer, consulting engineer, Penticton, B.C., or at Mather, Yuill & Co., Ltd., Vancouver. Tenders marked "Tender for Hydro-electric Plant," to be sent to the above F. H. Latimer, and to be accompanied by cheque for 5 per cent. of the tender payable to the municipality.

Dundalk.—July 24th. Buildings, plant and materials for the electric lighting of the Urban District for the U.D.C. See "Official Notices" July 7th.

Dundee.—It having been alleged that one of the offers for the work at the Downfield electric station had been lost, the Corporation Electricity Committee has agreed that new tenders be received.

Erdington (near Birmingham).—Construction of 1¼ miles of double track tramways. H. H. Humphries, engineer to the Council, Council House, Erdington.

Farnham.—August 16th. Two high-speed Diesel oil engines coupled to two 90-KW. alternators, with direct-coupled exciters, piping, tanks, overhead traveller, &c., and main H.T. switchboard, for the Farnham Gas & Electricity Co. See "Official Notices" to-day.

Frodingham.—August 11th. Poles, lamps, wires and switches for street lighting, for the Brumby and Frodingham U.D.C. See "Official Notices" to-day.

Gillingham.—July 24th. Coal for the electricity department. Particulars from Borough Electrical Engineer.

Hungary.—August 2nd. Electric lighting plant (public and private) for the authorities of the Grossgemeinde Pászto, Komitat-Heves, Hungary.—*Board of Trade Journal.*

London.—L.C.C.—August 1st. Electrical installation (250 lamps) at the Gt. College Street Elementary School, N.W. See "Official Notices" to-day.

HAMMERSMITH.—July 26th. High and low-tension feeder cables and stoneware ducts, for the B.C. See "Official Notices" to-day.

Manchester.—July 24th. Cast-iron plates for top of flue dampers, and opening apparatus, for third chimney at Stuart Street generating station for the Corporation Electricity Committee. Specifications, Secretary, Electricity Department, Town Hall. Deposit £1 1s. (returnable).

Pembroke (Co. Dublin).—July 31st. Installation of electric light in new artisans' dwellings and in new streets, for the U.D.C. Deposit 20s. Specifications, &c., J. C. Manly, clerk, Town Hall, Ballsbridge, Pembroke. Irish materials and labour and Dublin standard rate of wages.

Pontypridd.—August 1st. 1,700 ampere-hour storage battery, with motor-driven booster and switchgear, for the U.D.C. See "Official Notices" to-day.

Portsmouth.—July 24th. Supplying and fitting 350 metallic-filament lamps for globes in the large hall and banqueting room at the Town Hall, for the T.C. Borough Engineer, Town Hall.

Swinton and Pendlebury.—Tenders are to be invited for a 12 months' supply of materials required for the electricity department.

Tonyrefail.—August 1st. Mains, switchgear, and street lighting fittings at the Ely Valley Extensions, for the Tonyrefail and Gilfach Goch Electric Light Co., Ltd. See "Official Notices" to-day.

Walthamstow.—July 21st. Feeder cables and stoneware conduits for the U.D.C. See "Official Notices" July 7th.

Winchester.—July 24th. Electric wiring and fittings, for the County Hall, for Hants C.C. County Surveyor, The Castle, Winchester (returnable deposit of £2 2s.).

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

CONTRACTS CLOSED.

Aberdeen.—The D.P. Battery Co., Ltd., have secured the contract for the renewal of the Cults sub-station battery of the Corporation.

Atherton.—The Electricity Committee has ordered four transformers from the the British Westinghouse Electric & Manufacturing Co., for early delivery.

Australasia.—According to the *Australian Mining Standard*, orders have lately been placed as follows:—

NEW ZEALAND (GISBORNE):—

Two 100-KW. Diesel generating sets are now being manufactured for the Council of the Borough of Gisborne (N.Z.), and an order has recently been placed for a switchboard. The Council has also placed an order for eight sewage pumps to deal with the town's drainage, which will be of the vertical turbine type. The above orders have been secured by the British General Electric Co., Ltd., Sydney.

NEW SOUTH WALES.—P.M.G.'s Department:—

Western Electric Co. (Australia), Ltd.—Telephone apparatus for the Sydney Exchange, £745.

VICTORIA.—Railways Department:—

W. T. Henley's Telegraph Works Co., Ltd.—Lead-covered paper-insulated telephone cable, at £162 per mile.

WESTERN AUSTRALIA.—Public Works Department:—

C. C. Hemsley & Co. (Metropolitan Sewerage Contract).—Electric pumping machinery, contract No. 75, £5,519.

Belfast.—At a meeting of the Tramways and Electrical Committee on 17th inst., tenders for air and circulating pumps for the electricity works were received and referred to the engineer for report.

Bolton.—The Electricity Committee has accepted the following tenders for 12 months' supplies, viz:—

H. Wells, Moscrop & Co., W. Priestley & Co., J. Orrell.—Oil, &c.
G. Reason.—Cleaning waste.
Foster Engineering Co. and W. E. Burnand & Co.—Single-phase transformers.
Ferranti, Ltd., and Westinghouse Co.—Three-phase transformers.
British Insulated & Helsby Cables, Ltd.—Surface boxes, cable boxes, &c.
B.T.H. Co.—Incandescent lamps.
British Electric Cable Co.—Insulated cable.
British Westinghouse Co., Bat Meter Co., Chamberlain & Hookham, Electrical Co., and Bastian Meter Co.—Direct-current meters.
Ferranti, Ltd.—Motor starters.
British Westinghouse Co.—Continuous-current motors.

Dewsbury.—The T.C. has accepted the tender of Messrs. Cowans, Ltd., of Manchester, for a feeder switchboard, and that of Callender's Cable & Construction Co., Ltd., for feeder cables.

Dover.—The T.C. received the following tenders for three new tramcars and electrical equipment:—

CARS.

Brush Electrical Engineering Co., Ltd.	**(accepted)**	**£303**
United Electric Car Co.		335
British Thomson-Houston Co., Ltd.	£315 and	£343
Dick, Kerr & Co., Ltd.		341

EQUIPMENT.

British Thomson-Houston Co., Ltd.	**(accepted)**	**£372**
Brush Electrical Engineering Co., Ltd.		205
British Westinghouse Co., Ltd.		281
Dick, Kerr & Co., Ltd.		264

Government Contracts.—During the past month the following tenders have been accepted by the Government Departments named:—

WAR OFFICE.

Storage batteries.—Tudor Accumulator Co., Ltd.
Cable.—Western Electric Co., Ltd.
Telephone sets, &c.—Spagnoletti, Ltd., British Insulated and Helsby Cables, Ltd.

INDIA OFFICE STORE DEPARTMENT.

Accumulators, &c.—Pritchetts & Gold.
Cells, &c.—General Electric Co.
Switches.—T. Summerson & Son.

CROWN AGENTS FOR THE COLONIES.

Submarine cable.—Telegraph Construction and Maintenance Co.
River cable, &c.—Hooper's Telegraph and India-rubber Works, Ltd.

GENERAL POST OFFICE.

Telephonic apparatus—condensers.—Peel-Conner Telephone Works, Ltd.
Flexible cords.—British Insulated and Helsby Cables, Ltd.
Switchboards.—British L.M. Ericsson Manufacturing Co., Ltd., British Insulated and Helsby Cables, Ltd.
Loop cable.—Western Electric Co., Ltd.
Paper core cable.—W. T. Henley's Telegraph Works Co., Ltd., Siemens Bros. & Co., Ltd.
Insulators.—Bullers, Ltd., Doulton's, Ltd., Taylor, Tunnicliff & Co., Ltd.
Glow lamps.—Edison & Swan United Electric Light Co., Ltd., Omega Electric Lamp Co., Ltd., Rugby Lamp Co., Ltd., Siemens Bros. & Co., Ltd.
Extra telephone exchange, Victoria, S.W.—Western Electric Co., Ltd.
Equipment, telephone (local) exchange, Attercliffe, Sheffield.—British Insulated and Helsby Cables, Ltd.
Ditto, Bury, Lancs. and Doncaster.—Peel-Conner Telephone Works, Ltd.

Heston and Isleworth.—The Education Committee has accepted the tender of G. N. Virgo for the installation of electric light at the following schools:—Hounslow Town, £38, Grove Road, £41, Isleworth Boys', £14.

King's Lynn.—The T.C. has accepted the tender of Messrs. Coote & Warren for Bestwood nutty slack for the electricity works, at 8s. 4d. per ton.

London.—L.C.C.—For the laying of stoneware cable ducts from Brixton to Herne Hill, tenders were received as follows:—

Dick, Kerr & Co., Ltd.	**(recommended)**	**£2,181**
Westminster Construction Co., Ltd.,		2,204
J. A. Ewart		2,530
J. Mowlem & Co., Ltd.		2,588
Reid Bros. Engineers, Ltd.		2,668

HACKNEY.—With reference to the recently published list of tenders for 100,000 carbons for the Electricity Department, as the result of correspondence with Messrs. Ship Carbons, Ltd., Underwood (Manchester), Ltd., and W. Geipel & Co., it is now recommended that Messrs. Geipel receive the entire order at £2 15s. per 1,000 pairs instead of £3 which they quoted.

ISLINGTON.—The B.C. has accepted the tender of Messrs. Allen and Simmonds, Ltd., at £124, for supplying new pistons (including boring and fitting) to an engine at the generating station.

STOKE NEWINGTON.—The B.C. has accepted the tender of Messrs. Fryer & Co., Paddington, for the installation of electric lighting, wires and fittings at the Public Library, Church Street, for the sum of £180. The Mayor will personally bear the cost of the work plus £30 for the lamps—£210 in all.

South African Post Office.—The tenders of the South African General Electric Co., and Messrs. Siemens, Ltd., for the supply of dry cells to the department of Posts and Telegraphs, have been accepted by the Tender Board.

Sunderland.—The T.C., on July 13th, accepted the tender of the Albion Clay Co. for stoneware ducts for extensions.

Swinton and Pendlebury.—The U.D.C. has accepted the tender of Callender's Cable Co., at £84, for overhead service work.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, July 29th, to Saturday, August 5th. Summer meeting. Visits to works, &c., at Felixstowe, Ipswich, Norwich and Cambridge.

Friday, August 4th. At the University Arms Hotel, Cambridge. Summer dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

The following Orders are issued for the next few weeks:—

Saturday, July 22nd.—The Sheerness detachment will parade at headquarters at 3 p.m. Dress:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before this parade.

Headquarters will be open from 10 a.m. to 4 p.m. from Monday July 24th, to Friday, July 28th.

Saturday, July 29th.—Falmouth Detachment will parade at headquarters at 8.30 a.m. Weymouth Detachment will parade at headquarters at 11 a.m. Dress for the above detachments will be:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before each parade.

Headquarters will open from 10 a.m. to 4 p.m. from Monday, July 31st, to Friday, August 4th.

Saturday, August 5th.—Falmouth Detachment (2nd party) will parade at headquarters at 8.30 a.m. Weymouth Detachment (2nd party) will parade at headquarters at 11 a.m. Dress for the above detachments will be:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before each parade.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Society Day at the White City.—It has been decided that Friday next shall be set apart for a Society Day at the Coronation Exhibition, Great White City, Shepherd's Bush, W. The charge for admission will be 10s. The whole of the proceeds, without deduction, will form part of the Exhibition's contribution towards the King Edward VII Memorial Fund.

International Metal Statistics.—The usual statistics in relation to the world's production and consumption of metals have just been issued by the Metall Gesellschaft of Frankfort-on-Main, for 1910. As far as aluminium is concerned, the return shows a total output of 34,000 tons in 1910, as compared with 24,000 tons in 1909, and a consumption of 33,500 tons and 30,800 tons in the two years respectively. The quantity consumed in Germany in 1910 is computed at 10,000 tons as against 9,000 tons in the preceding year. The average price amounted to 1·45 mark (shilling) per kilogramme in 1910 as contrasted with 1·35 mark in 1909, 1·65 mark in 1908, and 3·65 marks in 1907. The details in regard to copper, tin, lead and zinc are given below :—

	1910. Tons.	1909. Tons.
COPPER.		
Production	877,600	846,700
Consumption	844,900	783,900
Average price	£57 3 2	£58 17 3
Stocks on January 1st, 1911 (tons)	148,500	175,100
TIN.		
Production	111,200	108,600
Consumption	117,900	105,600
Average price	£155 6 2	£134 15 6
Stocks on January 1st, 1911 (tons)	20,300	23,120
LEAD.		
Production	1,132,900	1,085,600
Consumption	1,115,700	1,080,500
Average price	£12 19 0	£13 1 8
ZINC.		
Production	816,600	783,200
Consumption	822,900	798,900
Average price	£23 0 0	£22 3 0

The consumption of the four principal metals in the four leading countries is returned as follows for the past two years :—

	1910. Tons.	1909. Tons.
United States—		
Lead	387,900	334,500
Copper	338,700	316,800
Zinc	245,400	237,300
Tin	49,000	42,800
Germany—		
Lead	208,400	213,200
Copper	199,800	179,400
Zinc	191,500	188,100
Tin	18,100	17,100
United Kingdom—		
Lead	209,300	202,700
Copper	146,000	108,300
Zinc	177,800	155,500
Tin	21,100	17,800
France—		
Lead	90,600	102,300
Copper	80,700	73,400
Zinc	66,200	66,900
Tin	7,330	7,300

The increase in the consumption of the metals is attributed to the expansion in the electrical engineering industry both in the United States and Europe; and although lead shows a diminution for 1910 in Germany and France, the actual consumption experienced an advance, as the stocks, which are not included in the figures, at the producing works were reduced during the year.

Electrical Power Distribution in Durham County.—In connection with the general spread of electrical power distribution throughout the Durham coalfields, a number of extensions have recently been carried out to the sub-stations and mains of the County of Durham Electrical Power Distribution, Ltd. A new sub-station, built in connection with the supply to the Easington colliery and township, is 20 ft. square, having two floors, brick built and concrete roofed. It contains one 700-H.P. transformer, with a ratio of 20,000 to 3,000 volts, of the A.E.G. oil-cooled type. A temporary H.T. switchboard has been installed in order to give a supply to the colliery, but there is no L.T. gear, the cable being connected directly to the transformers. Ironclad switchgear of the Reyrolle type, consisting of two feeder panels of 200 amperes capacity and one transformer of the same capacity, for 20,000 volts, has been provided. At Pelton Fell colliery, a new sub-station has been erected, and the plant here consists of one 700-H.P. three-phase air-cooled transformer of the Brown-Boveri type, with a ratio of 5,500 to 440 volts. The H.T. switchgear is of the Reyrolle ironclad type, with one 6,000-volt feeder panel, and one 6,000-volt transformer panel, while the L.T. Reyrolle gear consists of one 440-volt transformer panel. Balanced protective gear is installed, and there is one H.T. cable. An extension has been made to the South Pelaw sub-station situated between Pelton and Chester-le-Street, which sub-station supplies the South Pelaw colliery at 3,000 volts, and contains one 200-H.P. transformer, with a ratio of 5,500 and 2,750 volts. In this connection, new mains consisting of three-core armoured cables by Messrs. Callender & Co. have been laid from South Pelaw sub-station to the Pelton colliery. Each core is ·15 sq. in., running at a voltage of 6,000. The line is partly underground, and partly overhead, wooden "A" poles being used with a normal span of 80 yards, the conductors overhead being ·1 sq. in. in cross-section. New mains have also been laid in connection with the Old Ford colliery supply, these consisting of Callender & Co.'s three-core cable, each core being ·25 sq. in. in section, running at 6,000 volts, and laid solid in earthenware troughs. A large new sub-station has been erected in connection with the supply to the South Hetton Colliery; the first instalment of new plant consists of one 400-H.P. transformer with a ratio of 2,000 to 500 volts, and two 1,300-H.P. transformers, with a ratio of 20,000 to 2,000 volts, the smaller being of the British Electric Transformer Co.'s manufacture, and the larger by the A.E.G. The 400-H.P. transformer consists of three separate transformers. Reyrolle H.T. switchgear is used, and there are two feeder panels of 250 amperes capacity at 20,000 volts, and two transformer panels of like capacity; the L.T. switchgear is also of the Reyrolle type, with one meter panel and four transformer panels. The sub-station has a total capacity of 2,600 H.P., and supplies 2,000 to 500-volt motors, which have been installed by the consumers. A new sub-station, which has been built by the Easington Colliery, is divided into two portions, the consumers' sub-station and the supply company's sub-station. This building contains combined feeder and meter panels of the Reyrolle ironclad type. The total capacity of the machinery is about 1,000 H.P., and this represents one of the most recent examples of 20,000-volt sub-stations erected in the area of the north-east coast power system.

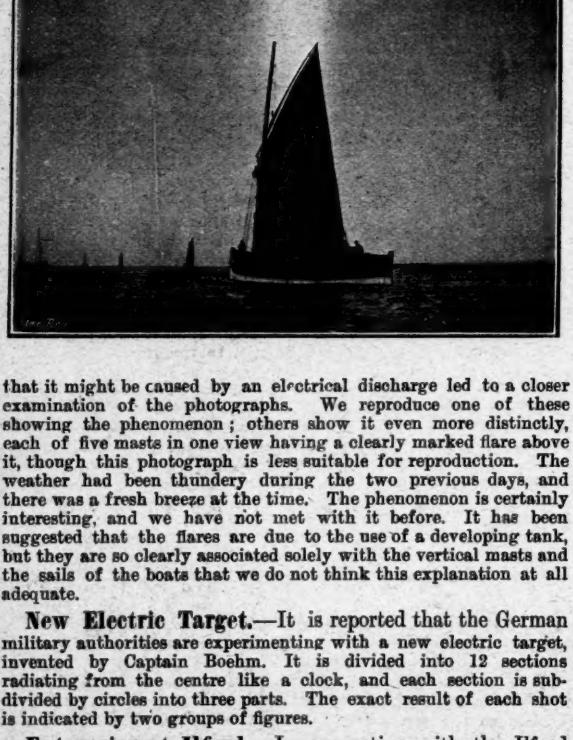
Cooling Towers on Island Power Houses.—Engineers visiting Galveston, Tex., often express surprise at finding cooling towers in use on local power plants, although Galveston is situated on an island in the Gulf of Mexico, with plenty of circulating water available on all sides. Attempts to use sea-water with surface condensers have failed at Galveston on account of the activity of submarine life in the waters of the Gulf of Mexico. In spite of any straining devices that could be employed, eggs and germs of barnacles and shellfish were admitted to the intake pipes, and, adhering to the pipe walls, soon grew to a point where they actually choked up the pipes. Before this action was understood a number of sea-water intakes were installed leading down to the bay, but these, some even 14 in. in diameter, were soon entirely closed by the growth of animal and vegetable life so that they are useless, and cooling of the condenser water by atmospheric evaporation has had to be resorted to.—*Electrical World.*

The Walk to Brighton.—The hon. secretary of this event sends us the following additional information for publication:—"Some further arrangements have now been made by the Committee of the London-to-Brighton Walking Race, which is confined to those engaged in the electrical trades, and will take place on July 29th, starting from Westminster Bridge at 5 a.m. The programme of the event will be published about two days prior to the race, and this will contain all the information concerning the event. A copy will be sent to competitors and to all who are officially connected with the walk, and each competitor, it is hoped, will be provided with at least one cyclist who has offered his services to the Committee to accompany the competitors from London to Brighton. More cyclists, however, are needed for this work and also to act as road marshals, stewards, &c., and they will oblige by communicating at once with the hon. secretary, S. C. Haynes, 94, Paul Street, London, E.C. Arrangements have been made for those who desire to stay on the Friday night close to the starting point, for accommodation at the Abbey Temperance Hotel, 229, Westminster Bridge Road, where each man will have a bedroom, a good breakfast and a cold bath for an inclusive charge of 3s. 6d. Those who can journey to the starting point from their homes on the morning of the race will also dress here. Luggage must be packed in a bag or stout parcel and labelled, so that the railway company can call for it soon after the race and deliver to the Baths at Brighton. More financial support is needed, and the Committee will be greatly obliged for any subscriptions to this end; and also the loan of a couple of motor cars to convey the necessary officials would obviously save the Committee a deal of expense in hiring the same. Entries should be forwarded at the earliest possible moment, and all who desire to avail themselves of the accommodation at the hotel will require to send notice to the secretary, so that this can be reserved. There is a likelihood that the time limit for the certificates will be extended, and that all competitors who finish the walk will receive a memento of their performance."

Electrical Exhibition, Olympia.—Arrangements that have been made by the management for this Exhibition include an elaborate display of cooking demonstrations in the galleries of Olympia. For this purpose, manufacturers who are exhibiting have had space granted to them without rental charge, and with a free supply of energy, on condition that they provide the demonstrations in question during the run of the Exhibition. This arrangement, it is hoped, will help in the stimulation of great public interest. It is also announced that one of the large firms of house furnishers and electrical contractors have already secured a large block of space in the galleries where they are erecting a Model Electrical Home. This, it is understood, will be of a most elaborate description, and will be quite worthy of a great exhibition. It is contemplated to install a garage, electrical laundry, electrical kitchens, country-house lighting, and a series of living rooms, all equipped in such a manner as to show the advantages of electricity in the home.

London Electrical Engineers.—On Saturday last the London Electrical Engineers (Royal Engineers) completed a fortnight in camp at Landguard; 80 rank and file attended, and enjoyed ideal weather throughout their training.

An Electrical Discharge?—We have received from Mr. Arnold Spiller, of Newcastle-on-Tyne, some interesting photographs, which apparently reveal an electrical phenomenon not hitherto observed. During a recent yachting cruise, Mr. Spiller took several photographs of Scotch herring boats at St. Abbs, and on developing the negatives found that in each case a white "flare" extended skywards from the masts and yards of the boats. The effect was at first ascribed to some defect in the camera or some kind of halation, but a suggestion by Mr. C. Faraday Proctor



that it might be caused by an electrical discharge led to a closer examination of the photographs. We reproduce one of these showing the phenomenon; others show it even more distinctly, each of five masts in one view having a clearly marked flare above it, though this photograph is less suitable for reproduction. The weather had been thundery during the two previous days, and there was a fresh breeze at the time. The phenomenon is certainly interesting, and we have not met with it before. It has been suggested that the flares are due to the use of a developing tank, but they are so clearly associated solely with the vertical masts and the sails of the boats that we do not think this explanation at all adequate.

New Electric Target.—It is reported that the German military authorities are experimenting with a new electric target, invented by Captain Boehm. It is divided into 12 sections radiating from the centre like a clock, and each section is subdivided by circles into three parts. The exact result of each shot is indicated by two groups of figures.

Enterprise at Ilford.—In connection with the Ilford Hospital Carnival, the Electricity Department entered two pictorial cars, one showing electricity in the cottage and the other its advantages in the mansion. Accompanying the cars were six collectors dressed in costumes representing various makes of lamp. Mr. A. H. Shaw, the Council's electrical engineer, is to be congratulated on having taken such an interesting and successful share in the proceedings.

City and Guilds of London Institute.—In consequence of the rebuilding of Gresham College, the head offices of the City and Guilds of London Institute have been removed temporarily to 3, St. Helen's Place, London, E.C.

New Athletic Club.—We are informed that Electrical Installations, Ltd., of 27, Martin's Lane, Cannon Street, E.C., have recently organised an athletic club for cricket, football, tennis, &c., and have taken grounds at Edmonton, which will be used for practice and matches.

The secretary would be glad to hear from other firms in the allied trades with reference to arrangements for matches, for the present and coming seasons.

The Stalybridge Tramway Accident.—At the resumed inquest into the Stalybridge tramway accident, held at the Ashton Town Hall, by Mr. J. F. Price, County Coroner—

Mr. J. A. Grundy, shed superintendent to the Board, said the car to which the accident occurred contained 34 passengers, and one had died from injuries received. The car had been in use six years. He could not say when he last examined it, but the report book showed that brake troubles were reported on the first two days of June. The defects were attended to, and there were no further reports about the car before the accident. He examined the car immediately after the accident, and found it was foul of the up rails. He found the magnetic brake handle in the proper position, but the operating handle was in the fifth power notch. He could not account for the failure of the brakes, and tar on the rails would not have had any effect on the magnetic brakes.

Wm. Coates, a motor inspector under the Board, said the brakes ought to be tried before the car reached the top of the hill. If the testing of the brakes was left until the top was reached, it might be too late to pull up if anything went wrong. The same handle controlled the power and the magnetic brake. If the driver lost his head on finding the car running away, it was not likely for him to have moved the handle the wrong way, and applied the power instead of the brake, because the handle had to be pushed in the opposite direction for the two purposes. He had known a magnetic brake to fail suddenly.

Ralph Waterhouse, the resident motor inspector, considered Napper a fully qualified driver. He had never known a magnetic brake to fail.

Mr. Robt. Blackmore, engineer-in-chief to the Joint Tramways Board, said he examined the grooves of the rails at the curve, and found nothing in them but loose sand. He found a flat place on the wheels, indicating that skidding had taken place quite recently. There was no tar on the magnetic brake blocks, which were practically new. With Colonel von Donop of the B. of T. he tested the magnetic brakes of the car, and found them in perfect order.

In reply to the Coroner, he said that, so far as he could judge the accident was due to the skidding of the wheels. The magnetic brake would not act when the wheels were stopped, and the car must have got beyond the driver's control. Everything pointed to a bad rail that morning. Napper had told him that on the first journey there was a slight rust which caused a very treacherous rail. It required much nerve to put on more power when a car was travelling 20 miles an hour down hill, but Napper told him that he did it, and he thought he did.

The Coroner remarked that he thought the rails were somewhat worn, but witness said he was convinced from what he saw that the car did not leave the rails before it overturned. He thought the wheels skidded at Daisyfield Terrace, and from there the driver began to lose control.

The Coroner, turning back to the driver's evidence, said it appeared that he did not apply the magnetic brake until he was within 10 yards of the compulsory stop. Addressing the jury, the Coroner said they were as far as ever from knowing the actual cause of the accident. The driver said the magnetic brake had failed to act, but it was apparently all right when examined by the officials.

The Coroner added that he did not think they could get any nearer the true solution if they called more witnesses, or learn whether the accident was caused by the wheels skidding or the driver losing his nerve.

After a short retirement the jury returned a verdict of "Accidental death," and expressed the opinion that the driver was not in any sense criminally to blame. They added the following resolutions to the verdict:—(1) That there should be a compulsory stop at Daisyfield Terrace, where all magnetic brakes should be tested; (2) if feasible, the radius of the curve at the bottom of Ditchcroft Hill should be enlarged.

A Chichester Introduction: Sequel.—On Monday, at Westminster County Court, before Judge Woodfall, Mr. George Bartlett, a Chichester solicitor, sued Mr. Horace Boot, consulting electrical engineer, for £21, as a fee for introducing defendant to members of the Chichester City Council, in connection with the transfer of the electric lighting powers for that city. Defendant denied that there was any agreement to pay plaintiff a fee, but plaintiff said that he offered to transfer to him 20 £1 shares in the company. Judge Woodfall said that there was no evidence of an agreement to pay money, and judgment was given for the defendant, with costs.

Shift Electricians in Australia.—A further application is to be made to the Electrical Trades' Wages Board by the employés' union in the interests of the men employed on private electrical installations. The union has decided to endeavour to have the award of June 15th, 1910, amended by asking that when men engaged on shift work are required to work on public holidays, they shall receive two weeks' leave annually on full pay, and when they are required to work on holidays in addition to their ordinary days of working they shall be paid time-and-a-half rates. It is also to be asked that special rates be paid men working broken shifts, that special overtime provisions be allowed men who are called out at irregular hours to attend breakages, and that shift electricians who are required to attend to steam and electric plants combined shall be paid 11s. a day.—*Sidney Morning Herald.*

Parliamentary.—In the House of Lords on July 17th, the Central London Railway Bill passed its third reading.

In the House of Commons on July 14th, the Lords' amendments to the Liverpool Overhead Railway Bill were agreed to.

Institution and Lecture Notes.—TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—The delegates to the annual Congress held in Edinburgh last week were entertained to dinner by the chairman and directors of the Edinburgh and District Tramways Co., Ltd. Mr. B. Hall Blyth, who presided, proposed the toast of "The Tramways and Light Railways Association," and said that there were 176 tramway systems owned by the Corporations in the country and 134 private concerns, all of which were represented upon that Association. The Hon. Mr. Stanley and Mr. A. de Turckheim replied.—Mr. George Balfour, London, who gave the toast of "The Edinburgh and District Tramways Co., Ltd.," said that, notwithstanding its tremendous financial burdens and the short route of 25 miles, the company made the system pay.—In reply, Mr. Hall Blyth said it was not the tramway company that had installed the cable system, it was the Corporation, and he was not sure that they were wrong in doing so. It cost an enormous sum of money to install the tramway system, but there was no tramway system in the world that was worked so cheaply as the Edinburgh system.

ASSOCIATION OF CONSULTING ENGINEERS.—Since the draft rules drawn up by the Provisional Committee were circulated in December last, a large number of meetings have been held to deal with points that have been raised by various engineers, and a number of important negotiations have been in progress. It was hoped that these negotiations would have been completed in time to call a general meeting to consider the rules and formally enroll members during the present month. Unfortunately, owing to the large number of interests to be considered, and the complexity of the considerations involved, this has been found impossible, but the Committee hopes to be able to call the meeting after the holidays. In the meantime, Mr. Dykes, the hon. secretary, would be obliged if all letters were sent to his new address, 11, Victoria Street, Westminster, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.—At the annual meeting of the Southern District, on the 12th inst., Mr. Horace Boot, M.I.E.E., was re-elected district chairman. A paper was read at a Western District meeting, on Saturday last, by Mr. B. Wyand, on "Municipal Engineering as a Profession." He said that municipal engineers must realise their own importance, and recognise the fact that supremacy was their place in local life. Even the chairman of the Council was merely a cipher when contrasted with the municipal engineer, and he should, as far as possible, be made to feel this. The chairman might be the better man in many ways, but when it came to engineering he should be made to recognise the fact that he must play fourth fiddle, and must feel happy that he had not been relegated to the orchestral triangle. A man was estimated in this world much at the value he placed upon himself, and the humble, shrinking individual who was led by his Council was never likely to command either respect or a periodical increase of salary.

INSTITUTE OF MARINE ENGINEERS.—On Saturday, July 17th, the Institute paid a visit to the Bow Generating Station of the Charing Cross, West End and City Electricity Supply Co., Ltd.

The B.A. Meeting at Portsmouth.—The *Times* gave its usual forecast of the B.A. meeting in its issue of Monday last. In connection with Section G (Engineering) the following papers are mentioned:—"The Gyro-Compass," by G. K. B. Elphinstone; "Electrical Steering," by B. P. Haigh; "Electrical Drives for Ships' Propellers," by H. A. Mavor; "Marine Engines Adapted for Burning Crude Oil," by J. H. Rosenthal; "Corrugation of Tramway Rails," by W. Worby Beaumont; "The Vibragraph," by W. Pollard Digby. In a discussion on the merits of superheated steam engines, suction gas plants, and Diesel engines, papers are promised by Captain H. R. Sankey and Messrs. Tookey and Day. Wireless telegraph matters will be brought forward by Prof. T. W. Howe and Captain Sankey. Prof. G. H. Biles is this year's president of "G." In the agricultural section, Messrs. J. H. Priestley and R. C. Knight will deal with "The Effect of High-Tension Electric Discharges and Current Electricity on Plant Respiration."

Copper.—Messrs. Merton's circular of statistics to mid-month shows withdrawals from stock of 2,273 tons, European visible supplies being now 67,899 tons. Of this, 202 tons has gone from French stocks, and quantities afloat from Chile and Australia are 1,150 tons less. Supplies from North America for the fortnight are somewhat low; from Spain and Portugal to this country only 157 tons are registered (average monthly, 8,968 tons), but Chilian and Australian shipments are well up to average. Total deliveries appear low at 16,989 tons, but the significance of statistics for the first fortnight may, of course, be considerably altered by those appearing at the end of the month. Rotterdam stocks are reported higher by 200 tons, and Hamburg by 100, than they were at the end of June.

American visible supplies, at 70,283 tons, dropped 3,822 tons during June. The world's supplies for June 30th, 1911, are thus 6,263 tons less than for the end of May, having dropped 4,700 tons a month since the end of March.

Electrical Fatalities.—A correspondent states that Mr. Reginald E. Brindley, assistant district electrical engineer of the Victoria Falls Power Co., by some means came into contact with a high-pressure electric wire (20,000 volts) in the transformer house. He was quite alone at the time, and was found dead on the floor, having, without doubt, been instantaneously killed.

The *Daily Chronicle* correspondent at Geneva states that a terrible accident happened at the village of Cossonay, near Lausanne, while preparations were being made for the annual festival. Eight men belonging to the Circus Gruss were placing the tent in position when the central pole came into contact with an overhead live wire at 13,000 volts, and five of the workmen fell dead on the spot. Three others received severe shocks. The victims were two Italians and three Frenchmen.

On July 13th a lineman, named Richard Archer, 30, employed in the Telegraph Department of the L.B. and S.C. Railway, met his death by receiving a shock at 6,600 volts from an overhead wire of the railway at the Crystal Palace Low Level Station. According to the evidence given at the inquest on Monday, deceased and another (Staplehurst by name) were making up the signals for an estimate for electric signalling. He mounted the iron ladder of a signal near Anerley Road bridge with a steel measuring tape in his hand, when his fellow-worker who held the other end of the tape received a severe shock and fell to the ground. When the latter recovered consciousness he found Archer lying near him face downwards. Staplehurst said that he could not say how Archer managed to touch one of the wires. According to the *Standard* report, Dr. Scott Turner attributed death to a fracture of the base of the skull. He said that deceased's left hand was burned as though by an electric current, and the measuring tape showed plainly at one end that it had made contact with the wire. Other evidence showed that the contact was very slight, but was sufficient to throw Archer to the ground. Verdict: "Accidental Death."

Appointments Vacant.—Teacher of technical mathematics with special reference to electrical engineering, for evening classes at the Tottenham Polytechnic (12s. 6d. per lesson). Assistant engineer at the Poplar Workhouse (£120). Chief assistant engineer for the Burgh Electricity Department, Falkirk (£100). See our advertisement pages to-day.

MR. A. HUGH SEABROOKE, general manager of the Marylebone Electric Supply, writes, as we go to press, to say that if any supply engineer is looking round for a first class boiler-house and steam-plant superintendent, he can recommend a man whose capabilities, he believes, cannot be excelled throughout the country.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. C. B. LEWIS has resigned his position of assistant engineer at the Taunton Borough Electric Light Works, and MR. APPLEBY, of Smethwick, was on Tuesday appointed by the Council to fill the vacancy.

The Bedford T.C. has increased the salary of MR. JENKINS, deputy electrical engineer, from £170 to £190 per annum, with a further increase to £200 next year.

Tramway Officials.—MR. CHAS. W. HILL, general manager of the Bournemouth Corporation Tramways since 1908, has resigned, and will leave the town in October next. Mr. Hill has secured an appointment with a private firm in London.

MR. A. G. BALFOUR, manager of the electric tramways at Dartford, has been appointed to a similar position at Carlisle, and leaves the former town in August.

The Exeter City Council has again been recommended to increase the salary of the tramways manager from £160 to £170 per annum as from March 31st last. The Council had asked the Committee to recommend an instant increase to £170, and annual increments of £10 to a maximum of £200.

General.—DR. RUDOLF DIESEL, the inventor of the Diesel engine, has been re-elected a director of the Diesel Engine Co., Ltd.

MR. A. E. SAVILLE has been appointed manager and secretary of the Farnham (Surrey) Gas and Electricity Co., Ltd.

The marriage took place at Castlemere, Rochdale, last week, of MR. FRANK WHIPP, son of the late Mr. T. Lancaster Whipp, of Yorkshire Street, Rochdale, and a member of the firm of Whipp and Bourne, electrical engineers and contractors, of Molesworth Street, Rochdale, and Miss Ethel Coulthard, only daughter of Mr. Thos. Coulthard, of Shawlands, Manchester Road, Rochdale.

We are asked to state that MR. HARRY GUEST is not now connected with the Reason Manufacturing Co.

MR. SYDNEY H. BILL, at present chief electrician at the Houghton Main Collieries, has accepted the position of electrical engineer with the Ebbw Vale Steel, Iron and Coal Co., where he takes up his duties on September 1st.

Obituary.—We regret to report the death, which occurred on the 15th inst., from heart failure, of MR. R. B. GOODYER, at his house, in Newport Road, Cardiff, at the age of 73 years. The late Mr. Goodyer had a long connection with tramway systems, having held managerial appointments with the Edinburgh Street Tramways Co., the Rothesay Tramways Co., the London Road Car Co., Ltd., and the Continental Metropolitan (Paris) Tramways, Ltd., while for over 20 years he was manager of the Cardiff Branch of the Provincial Tramways Co., Ltd. Mr. Goodyer's son is the tramways manager to the Croydon Corporation, with whom we express our sympathy in his bereavement.

NEW COMPANIES REGISTERED.

Anglo-Brazilian Power and Shipping Corporation, Ltd. (116,742).—This company was registered on July 11th, with a capital of £300,000 in £1 shares, to promote, purchase, apply for or otherwise acquire, contract for and hold, construct, equip, maintain, hire, work, use, grant running or other powers over or in respect of, control, lease, sell, charter or let any works in South America or elsewhere, and in particular factories, roads, tramways, railways, ropeways, telegraphs and telephones (elsewhere than in the United Kingdom), cables, ships, harbours, piers, docks, elevators, sidings, reservoirs, warehouses, bridges, canals, wool, cotton, corn, paper, banana, saw and crushing mills, smelting, ordnance, iron, steel, engineering, hydraulic, gas and electric power and light works, &c., and to adopt an agreement with Horacio P. Vieira, relating to the sale of 6,000 hectares of land in the State of Parana, Brazil, with water rights; purchase consideration, £270,000 in shares and £30,000 in cash. The British South American Financial Corporation, Ltd., of London Wall Buildings, E.C., are to receive £100,000 shares for services rendered in connection with the promotion of the company and the acquisition of the property; J. P. Nelson is to receive £5,000 shares from the vendor for services rendered in connection with the promotion and formation of the company. The subscribers (with one share each) are:—A. W. West, 124, Strathyre Avenue, Norbury, S.W., clerk; G. Rawley, 28, Cumberland Market, N.W., clerk; A. Evans, 424, Mile End Road, E., clerk; J. Oxley, 9, Rockbourne Road, Forest Hill, S.E., clerk; W. B. Place, 12, Woronzow Road, St. John's Wood, N.W., solicitor; J. Morris, 4, London Wall Buildings, E.C., chartered accountant; F. L. Adams, 19, Butler Road, Harrow-on-the-Hill, clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than ten; the first are Horacio P. Vieira, Cantylo, Parana, Brazil, merchant; J. P. Nelson, Kenilworth, Winchmore Hill, N., Brazilian merchant; and J. Wolstenholme, 4, London Wall Buildings, E.C., merchant; qualification (except subscribers acting as directors and directors appointed by them), £5,000; remuneration, £500 each per annum (chairman, £1,000) and a percentage of the profits. Registered office, 4, London Wall Buildings, E.C.

Launceston and District Electric Supply Co., Ltd. (116,654). This company was registered on July 5th, with a capital of £10,000 in £1 shares, to carry on at Launceston and elsewhere in Cornwall the business of an electric light company in all its branches. The subscribers are:—C. H. Gillbard, Trehearne, Launceston, merchant, 50 shares; T. B. Hender, J.P., Landrends, Launceston, tanner and leather merchant, 50 shares; J. Kittow, West Holm, Launceston, auctioneer and land surveyor, 50 shares; W. Prockter, J.P., Pennygillam, Launceston, ironmonger, 50 shares; R. B. Rogers, Hexworthy, Launceston, A.M.I.C.E., 100 shares; W. H. Symons, Church Street, Launceston, jeweller, 50 shares; T. P. Trood, J.P., Broomhill, Launceston, merchant, 50 shares. Minimum cash subscription £4,000. The number of directors is not to be less than four or more than nine. The first are C. H. Gillbard, T. B. Hender, J.P., J. Kittow, W. Prockter, J.P., R. B. Rogers, W. H. Symons and T. P. Trood, J.P.; qualification, £50; remuneration as fixed by the company. Office, Westgate, Launceston.

Halls, Builders, Ltd. (116,633).—This company was registered on July 4th, with a capital of £1,000 in £1 shares, to take over the business of builders and decorators carried on as "Hall & Co." at 5, Blackstock Road, Finsbury Park, N., and the business of electrical engineer carried on by C. Wainwright, at 47, Foxham Road, Tufnell Park, N. The subscribers (with one share each) are:—W. Hall, 5, Blackstock Road, Finsbury Park, N., builder; H. H. Trendler, 5, Blackstock Road, Finsbury Park, N., electrician. Private company. The number of directors is not to be more than four; the first are A. C. Edwards and H. H. Trendler; qualification, £1; remuneration as fixed by the company. Registered office, 5, Blackstock Road, Finsbury Park, N.

Wilson Apparatus Co., Ltd. (116,761).—This company was registered on July 11th, with a capital of £900 in £1 shares (300 "A" and 600 "B") to carry on the business of electricians, engineers, manufacturers of and dealers in instruments and apparatus used in connection with the generation, supply, accumulation and employment of electricity, &c., and to adopt an agreement with F. W. Wright, E. Wilson and W. H. Wilson. The subscribers (with one share each) are:—E. Wilson, King's College, London, professor of electrical engineering; W. H. Wilson, 14, Cobham Road, Norbiton, electrical engineer; F. W. Wright, York Villa, Stanmore, Carlisle, electrical instrument maker. Private company. Table "A" mainly applies. Registered by Bircham & Co., 46, Parliament Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Union Electric Co., Ltd. (71,115).—Return dated May 18th, and filed June 2nd, 1911. Capital, £25,000 in £1 shares; 24,250 shares taken up; £1 per share called up on 4,250, and 1s. per share on 19,500; £5,225 paid; £600 considered as paid on 500 shares. Mortgages and charges: Nil.

Gilbert Arc Lamp Co., Ltd. (52,679).—Mortgage dated June 30th, 1911, to secure £500 and further advances, charged on the company's book debts. Holders: Engineering and Arc Lamp, Ltd., 3-4, Fenchurch Street, E.C.

Imeson, Finch & Co., Ltd. (97,639).—Debenture dated June 28th, 1911, to secure £800, charged on the company's undertaking and property, including uncalled capital. Holders: Hanson, Brown & Co., Ltd., Middlesbrough.

Staniar, Clegg & Co., Ltd. (114,935).—Debenture dated June 13th, 1911, to secure £170, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. D. Staniar, 112, Portland Street, Manchester.

Barnsley and District Electric Traction Co., Ltd. (72,962).—Return dated June 6th, filed June 21st, 1911. Capital £50,000 in £5 shares (5,000 pref.); 4,400 pref. and 4,007 ordinary shares taken up; £5 per share called up; £42,035 paid. Mortgages and charges: £21,000.

Birkdale District Electric Supply Co., Ltd. (70,259).—Return dated May 29th, filed June 21st, 1911. Capital £30,000 in £5 shares. All shares taken up and paid for in full. Mortgages and charges: £3,000.

Reason Manufacturing Co., Ltd. (64,701).—Mortgage dated July 4th, 1911, to secure £1,000 and certain costs, &c., charged on the present and future indebtedness to the company of Motor Meters, Ltd., and of the Municipal Corporation of Stepney. Holders: Barclay & Co., Ltd., London and Brighton.

"Z" Electric Lamp Manufacturing Co., Ltd. (96,594).—Floating charge on stock of manufactured lamps for time being at factory at Southfields, dated June 27th, 1911, to secure any moneys to the extent of £9,500, which the mortgagees, as guarantors, may become liable. Holders: Kilburn Brown & Co., Orient House, New Broad Street, E.C.

Woking Electric Supply Co., Ltd. (46,115).—Issue on June 17th, 1911, of £12,000 debentures, part of a series of which particulars have already been filed, secured by trust deed of March 1st, 1906. Present issue makes total now issued £60,250. The £12,000 debentures are issued as collateral security.

Simms Magneto Co., Ltd. (95,109).—Issue on May 31st of £2,500 debentures, part of a series of which particulars have already been filed.

O. Ruhl, Ltd.—A memorandum of satisfaction in full on July 4th, 1911, of debentures dated November 5th, 1909, securing £800, has been filed.

Cutting Brothers, Ltd.—A memorandum of satisfaction in full on November 10th, 1910, of debentures dated June 20th, 1904, securing £4,000, has been filed.

CITY NOTES.

Chatham and District Light Railways Co.

THE report shows that the result of the working for the half-year ended June 30th, 1911, is as follows:—Revenue, £21,445; expenses, £12,514—leaving £8,930. Less rent of Rochester Corporation lines, £1,872; interest on debentures, £1,234; interest account, £226—leaving £5,598. Plus balance brought forward, £638—leaving a balance of £6,236, which is to be disposed of as follows:—£2,940 to dividend at the rate of 5 per cent. per annum on the preference shares, £1,590 to dividend at the rate of 3 per cent. per aunum on the ordinary shares, £1,706 to revenue new account. The traffic receipts show a small increase of £71 and the expenses a decrease of £190, as compared with the receipts and expenses for the corresponding half-year of 1910. Rochester Bridge is in course of reconstruction, and the work, which necessitates lifting and relaying the company's track and overhead line, is considerably interfering with the traffic. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year. The dividends are to be paid on August 4th.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
December, 1909..	14·98	4,712,205	£23,045	1·17d.	582,637	45
June, 1910 ..	14·98	4,347,656	21,029	1·16	556,218	45
December, 1910..	14·98	4,869,431	23,799	1·17	586,902	45
June, 1911 ..	14·98	4,372,850	21,101	1·16	551,834	45

American Westinghouse Electric Co.

IN our issue of June 16th we gave a summary of the figures appearing in the last report of the above company. From the *Electrical World* of June 15th, we now give some lengthy, but very interesting, extracts showing the general position of affairs and the experience of the American company in connection with its various ventures in Europe:—

"The report points out that the year's business, both in gross earnings and net income, is the largest in the history of the company; and, as the past year was a period of somewhat less than normal activity in other lines of industry, the showing affords a sound basis for continued hope in the future of the electrical manufacturing industry, and in the maintenance by the company of its position in that field. On the other hand, the volume of business now offering is on a dimishing scale, the volume of unfilled orders as of March 31st, 1910, being $11,256,196, as compared with $7,616,058 as of March 31st, 1911. The results of last year are thus no certain indication of a continuance for the future of gross earnings and profits such as the past 12 months have produced."

"The statement is made that the patent agreement entered into with the General Electric Co., March 31st, 1896, expired by limitation on April 30th, 1911, and that no renewal is contemplated. Patent licence agreements with other manufacturers under which the company has been working for some years have recently been cancelled, on the suggestion that they might be questioned as being in violation of the federal anti-trust laws, notwithstanding that they were originally made and have been maintained under the advice of counsel that assured the company of their validity.

"In order to strengthen the company's position the directors have authorised a considerable increase in the expenditures of the selling organisation in order to increase the number of salesmen in the field, for remuneration to representatives adequate to secure the best efforts on their part, for the extension of advertising, and to provide for proper warehouse facilities for carrying stocks at distributing points. While this has added considerably to the aggregate selling expenses, the action has been justified in increased volume of business. The report states that it is a matter of simple computation, on the basis of the operations for the past two years, to ascertain the point at which the volume of gross business fails to provide a surplus over operating expenses and fixed charges, and it is vital that the business shall not drop to that point.

"With the same purpose in view fairly large expenditures have been authorised for the work of new development and for improvements in types of apparatus, such as the re-designing of direct-current motors, alternating-current and direct-current mill and crane motors, small power motors, high-speed turbo-generators, circuit-breakers, railway equipment and heating and cooking apparatus. The cost of new development and re-designing is charged monthly as a part of the current cost.

"After a thorough discussion in detail of the assets and liabilities of the company, and taking into account the elements of uncertainty as to the immediate future of the company's business, the need for cash for new foundry facilities, for the extension of the Newark plant and other factory improvements, and the necessity of making wide provision for shortly maturing obligations, it is stated that the directors have felt that it is not wise at the present time to weaken the company's position by diverting its surplus earnings, even in part, to the payment of dividends on the assenting stock. Whenever changed conditions shall allow the directors to feel that a change of attitude can safely be

assumed, the question will be reconsidered and determined in the light of such a change.

"The report discusses in detail the various items of the balance-sheet, and in particular gives full details concerning the investments in affiliated and subsidiary companies.

"The first foreign Westinghouse company, organised July 11th, 1889, was the Westinghouse Electric Co., Ltd., a corporation of Great Britain. The entire issue of capital stock of this company was carried as an investment on the books of the American company at an aggregate value of $1,773,084, this representing the expenses incurred from 1889 to 1906 in the efforts to establish the manufacture and sale of the company's products in foreign countries. On March 31st, 1910, the assets of the company consisted of practically the patents owned by it in various European countries and of certain licences granted by it under some of its patents. The income had long been insufficient to pay the expenses of the operation of the company and the up-keep of its patents. During the year ended March 31st, 1910, the directors wrote off from the book value of this item $773,084, and during the fiscal year just ended an additional $500,000, leaving the present book value $500,000. It is added that further depreciation of this item must be contemplated.

"The next foreign company, organised July 10th, 1899, was the Westinghouse Electric and Manufacturing Co., Ltd., a corporation of Great Britain, which constructed and equipped immense works for the manufacture of electrical apparatus, steam turbines and gas engines at Trafford Park, near Manchester, England. The preference shares and mortgage debenture stock were sold for cash at substantially par, and the aggregate of the face value, or $18,145,572, represents approximately the amount of money spent in producing the facilities of the British company and in paying the losses incurred in its operation prior to 1907. Its operations, it is stated, have been quite uniformly unprofitable. Several reductions have been made in the capital of the company, and a further reduction seems to be forecast by the necessity for providing for the payment of an award against it, aggregating with costs about $485,000, in an arbitration proceeding recently decided between the British company and the London Underground Railway. The American company own preference shares of the British company to the face value of $2,600,143; ordinary shares, $922,615; and mortgage debenture stock, $3,273,750. Of these, the ordinary shares do not appear on the books of the company as an investment of any value. The preference shares, having a par value of $2,600,143, were carried as an investment until 1910 at a book value representing the original cost of acquisition, or $4,458,083. On March 31st, 1910, there was written off as depreciation of this item the sum of $3,564,563, leaving the present book value $893,520. This corresponds to the present market value of the shares on the London Stock Exchange. The debenture stock, having a par value of $3,273,750, is carried on the books as an investment at the cost of acquisition, $3,137,104. This yields a return of 4 per cent. on par. Recent sales on the London Stock Exchange have been at the price of 62 per cent. of par.

"On November 28th, 1901, the Société Anonyme Westinghouse, of Paris, was organised, which company operates a factory at Havre, where it manufactures a general line of electrical apparatus and certain condensing apparatus for steam engines and turbines. It also has a factory at Freinville, near Paris, for the manufacture of Westinghouse air brakes. Its territory includes France, Belgium, Holland, Switzerland, Spain and Portugal. The operations of the company are stated to have been steadily unprofitable, and, while it earns and pays interest on its debentures, it was only in the year 1908 that it paid dividends on its preference shares. Of the out standing capital of the French company the American company owns preference shares to the par value of $893,348; ordinary shares, $556,563, and 5 per cent. debentures, $1,447,500. During the receivership of the American company the Court authorised the receivers to advance money to the French company, and in 1909 preference shares to the value of $671,398 were purchased at par. The debentures of the French company are now carried on the books as an investment at cost, aggregating $1,430,730. The preference shares are likewise carried at cost, aggregating $896,536. Prior to March 31st, 1910, the ordinary shares were carried as an investment at cost, $494,032; during the year ended March 31st, 1910, there was written off for depreciation of this item $275,057, and during the last fiscal year a further sum of $218,974, leaving the book value of the ordinary shares at $1. It is believed that with careful management the debenture and preference shares of the French company may be made worth their face value.

"On March 11th, 1907, the Societa Italiana Westinghouse was organised. It constructed a factory at Vado, Italy, for the primary purpose of executing important contracts for the electrification of certain of the Italian street railways. Delay by the Italian Government in carrying out its programme for the improvement of its railway lines has temporarily disappointed the expectations with which this company was organised and its plant created, so that it is now looking to the general market for orders for electrical apparatus to keep its works in operation. The amounts advanced by the American company appear in the balance-sheet under the items notes and accounts receivable at $289,746. For the purpose of capitalising certain advances recently made to it by the French company and the American company, the Italian company is about to create an issue of $772,000 of 5 per cent. debentures, of which approximately $289,500 will be received by the French company and $48,500 by the American company. In 1908 the net surplus of the Italian company was $32,953; in 1909, $45,782, and in 1910 there was a loss of $32,940.

"In July, 1906, the Société Electrique Westinghouse de Russie was organised, primarily to execute a contract amounting to over $5,150,000 for the electrification of St. Petersburg tramways. Upon the organisation of the Russian company, the American company advanced to it sums aggregating $895,888, of which there remains due $290,000. The American company purchased from the Russian company 5 per cent. debentures at a cost aggregating $2,243,243, and subscribed for its shares an aggregate of $696,322. Of the 'apport' shares the American company owns $198,962. The Russian company owes the American company on open account for material, $32,355, and unpaid interest on debentures aggregating $324,324. The total investment in and accounts due by the Russian company at the close of the last fiscal year, therefore, amount in the aggregate to $3,785,207.

"As of March 31st, 1910, the investment in the cash and 'apport' shares was written off to $1 for each class of shares, leaving the book value of this investment $2,243,245, a further depreciation of which may be required. Other items carried against the Russian company are, accounts receivable, $32,355, and notes receivable, $290,000. The execution of the St. Petersburg contract resulted in a loss of approximately $1,030,000, and in its other operations the losses to the Russian company have aggregated $815,978, the aggregate to date being, therefore, in excess of $1,800,000. There are other losses not yet definitely ascertained, due to the difference between the actual value of the Moscow plant and the price paid for it, and to depreciations occurring since the property was acquired, not entered on the books. The city of St. Petersburg is withholding from the amount due by it to the Russian company an aggregate of over $360,500, by way of fines imposed for alleged delays in the performance of the contract, and the company is urging a large claim for extras. It is said that there is reason to hope that the fines may be substantially remitted, but until these disputes are adjusted and payment is made it is impossible to predict how much of the investment in the Russian company can be realised. To maintain the company as a going concern advances approximating $110,322 to March 31st were made, being secured by mortgage. During the past year improvement in the operation and increase of the business of the Moscow plant have encouraged the hope that it may at least earn its operating expenses.

"On September 6th, 1906, an Austrian company, the Westinghouse Metallfaden-Gluhlampen-Fabrik Gesellschaft, was organised, which operates a factory for the manufacture of tungsten lamps near Vienna. Of the outstanding capital stock of the company, $324,800, the American company owns $249,690, which is carried among investments at the cost of acquisition, aggregating $250,626. The shares of this company are stated to be safely considered worth their par value.

"At the same time the Austrian lamp company was organised the Westinghouse Metal-Filament Lamp Co., Ltd., was organised in Great Britain with a capitalisation of $48,500, 80 per cent. of which is owned by the Westinghouse Lamp Co. and carried on the books at $38,800. This company was organised to control the patents covering the tungsten-lamp manufacturing processes for the territory outside of that of the Austrian lamp company, and it is believed that the book value of the investment will be realised.

"The Canadian Wessinghouse Co., Ltd., has issued $4,376,600 of capital shares, of which the American company owns $1,710,000; of this $500,000 was acquired in consideration of the transfer of patent rights and manufacturing information for Canada, and $1,210,000 for cash. The shares are carried on the books as an investment at par, $1,710,000. The Canadian company has been uniformly and increasingly successful, and has paid dividends regularly since 1903 at the rate of 6 per cent. per annum, with an extra 1 per cent. for 1910. The shares may therefore be considered worth in excess of their book value.

"Of the capital stock of the Westinghouse Machine Co. the electric company acquired $250,000 par value as part consideration of adjustment of relations. These shares were taken on the books at the time of the acquisition at a value of $218,538, and they are now carried on the books at a value of $125,000.

"The company holds $500,000 of 5 per cent. mortgage bonds of the Nernst Lamp Co., which comprises in part money advanced and materials furnished to that company, and in part an unpaid balance on the sale to it of a factory building. These bonds are carried on the books at par. All of the capital stock of the Nernst Lamp Co. is owned by the Westinghouse Machine Co.

"In 1901 the Traction and Power Securities Co., Ltd., was organised in Great Britain as a securities-holding company, and has an outstanding capital of $4,142,385 in ordinary shares. Its assets consist of $3,007,000 par value 4 per cent. prior lien debentures of the Mersey electric railway, which earns a small surplus over and above the interest on its debentures, the market value of which is 81, and $1,670,679 par value ordinary shares of the Clyde Valley Electrical Power Co., which owns and operates two power plants on the Clyde River, near Glasgow, Scotland. Work under way will involve a further expenditure by the latter of $970,000, secured by mortgage to the Traction and Power Securities Co. The receivers of the American company acquired at par $820,377 of the capital stock of the Traction and Power Securities Co., the value of which depends upon the receipts of the Mersey Railway and the Clyde Valley Electrical Power Co. It is believed that eventually the stock may be worth substantially par, and it is carried on the books at a value of $820,135."

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors have (according to a financial daily) declared an interim dividend of 2¼ per cent. on the preference shares and 2 per cent. on the ordinary shares.

City and South London Railway Co.

THE directors report that the receipts from all sources for the past half-year have amounted to £93,873, and the cost of working has been £42,738, leaving a profit of £51,135. Including the balance brought forward the net revenue account shows an aggregate total of £52,923. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500 and £800 for general purposes, a balance remains available for dividend of £36,049. Out of this the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of 1¾ per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving a balance of £2,798 to be carried forward.

Half-year.	Number of passengers (exclusive of season ticket holders until 1910).	Receipts (including season tickets).	Dividend per cent. per annum on ordinary stock.
Ended December 31st, 1909	11,234,074	£81,469	1¾
Ended June 30th, 1910 (inclusive of estimated number of season ticket journeys)	12,357,324	83,412	1¾
Ended December 31st, 1910 (inclusive of estimated number of season ticket journeys)	12,800,719	86,108	1¾
Ended June 30th, 1911 (inclusive of estimated number of season ticket journeys)	13,818,622	87,590	1¾

Prior to the Coronation period the traffic has shown a marked increase, which was further augmented during the processions and illuminations associated with this great event. The result of the half-year's working is that the directors are in a position to recommend a dividend on the ordinary stock at the rate of 1¾ per cent. per annum, carrying forward the balance of £2,798, as against 1¾ per cent. per annum and £1,634 for the corresponding half-year in 1910. The enormous number of passengers using the railway during the Coronation celebrations were carried without a single mishap or delay of any kind. The High Level subway connecting the public subways of the Central London Railway and the booking hall of the Bank Station was opened by the Lord Mayor in May last, and its utility and convenience have been since amply demonstrated by the free use of the subway made by large numbers of the public. The directors deemed it prudent to avail themselves of an opportunity to dispose of the small unissued balance of preference stock, 1903, on favourable terms, enabling them to pay off the temporary loan. The death is announced of one of the directors, Mr. Harvey Ranking, who, during his association with the company, displayed warm interest in its affairs and devoted much time and attention to its welfare and advancement. As mentioned last week, the vacancy has been filled by the election of Mr. J. F. S. Gooday. Warrants for the dividends will be posted on August 4th.

National Telephone Co., Ltd.

THE report of the directors for the half-year ended June 30th, 1911, to be submitted at the meeting on Thursday, July 27th, states that the income accrued in respect of the business of the half-year amounts to £1,807,872, as compared with £1,678,312 for the corresponding period of 1910, being an increase of £129,560. The working expenses for the half-year amount to £1,058,169, as compared with £971,914 for the corresponding period of 1910, being an increase of £86,255. The net result for the half-year (after deducting the Post Office royalties amounting to £173,424) is a profit balance of £576,278, as compared with £544,516 for the corresponding period of 1910, being an increase of £31,762. The rentals carried forward for unexpired terms of running contracts amount to £1,577,419, as compared with £1,482,179 at the corresponding period of 1910, being an increase of £95,240. Out of the available balance of £436,887 shown by the net revenue account the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 6 per cent. per annum on the deferred stock, less income-tax in all cases. The board also propose to transfer £200,000 to the reserve fund account, and to carry forward the balance of £18,137. On March 20th, 1911, the directors invited tenders for the repayment of part of the 3½ per cent. debenture stock, and up to May 31st last the amount of stock which had been thereby extinguished was £336,972. The sum of £211,122 has been expended on capital account during the half-year in the erection of 15,675 additional exchange and private stations, and in the construction of underground works.

Cordoba Light, Power and Traction Co., Ltd.—At an extraordinary general meeting, held in London last week, Sir J. Irving Courtenay presiding, a resolution was passed increasing the capital by 200,000 new shares of £1 each, making it £1,000,000. The new shares are not to be issued at present, but borrowing powers, which the increase of capital will give, will be exercised in the course of six months or so, the money being required for extensions of the business. The money will be raised by short-dated notes in preference to long-dated debentures, as they are looking for good results from their hydro-electric plant and tramways when they are fully at work.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Mississippi River Power Co.—Scrip, fully and partly paid, for $3,500,000 first mortgage 5 per cent. 40-year gold bonds.

And to allow the following securities to be quoted in the Official List :—

Bombay Electric Supply and Tramways Co., Ltd.—Further issue of £30,000 5 per cent. second mortgage debentures of £100 each, Nos. 1,701 to 2,000.

British Columbia Electric Railway Co., Ltd.—Further issue of £200,000 deferred ordinary stock; £200,000 preferred ordinary stock; and £200,000 5 per cent. cumulative perpetual preference stock.

Cascade Water, Power and Light Co., Ltd.—$285,500 first mortgage 33-year sinking fund gold bonds of $500 each.

Cuban Telephone Co.—£441,620 5 per cent. first mortgage convertible bonds.

Mexico Tramways Co.—$5,664,200 additional common stock in shares of $100 each.

Underground Electric Railways Co. of London, Ltd.—467,000 shares of £10 each, fully paid, Nos. 1 to 7,200, 8,201 to 26,792, 46,793 to 47,692, 50,693 to 469,200, 474,201 to 480,200, and 484,201 to 500,000.

British Columbia Electric Railway Co.—The *Times* states that a circular has been issued by the directors inviting applications from existing stockholders for £600,000 of new capital divided into the following classes and issued as follows :—200,000 5 per cent. cumulative perpetual preference shares of £1 each, at 1s. premium ; 200,000 preferred ordinary shares of £1 each, at 2s. premium ; and 200,000 deferred ordinary shares of £1 each, at 4s. premium.

The directors announce that a dividend of 5 per cent. per annum will be paid on the 5 per cent. non-cumulative preferred ordinary for the half-year ended June 30th, together with an additional dividend of 1 per cent. per annum for the same period, payable July 31st.

American Telephone and Telegraph Co.—The *Times* states that the gross earnings for the six months ended June 30th last amounted to $18,204,000, as against $17,596,000 for the corresponding period of 1910. The net earnings, after payment of interest, were $13,555,000, against $13,315,000, and after payment of dividends $2,786,000, against $2,963,000.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended May 26th, 1911, were 881,872, compared with 786,249 units in the corresponding four weeks of 1910.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 7 per cent. per annum, and on the ordinary chares at the rate of 10 per cent. per annum, for the half-year ending June 30th. The share transfer books will be closed from July 22nd to August 4th.

Japan.—The half-yearly general meeting of the Yokohama Electric Co. was lately held in that city, when a dividend at the rate of 12 per cent. was declared, and the sum of £970 carried forward. A scheme for the amalgamation of the company with the Yokohama Electric Light and Gas Co. and with the Enoshima Electric Tramway Co. was also submitted and approved, the capital of the company being increased for the purpose. By a later mail we learn that the shareholders of the tramway company have not approved the amalgamation scheme, and that, for the moment, the matter is in abeyance.

Presiding at the half-yearly general meeting of the Tokio Electric Light Co., when a dividend at the rate of 11 per cent. was declared, the president, Mr. Satake, stated that, in view of the creation of a new electric lighting company in Tokio and the extension of the electric lighting department of the Tokio Railway Co., some competition was inevitable, although it was impossible for any of the companies to continue reckless competition for any length of time at the sacrifice of the interests of their shareholders. Notwithstanding the competition, he did not hesitate to declare that the dividend of the company would not in the future fall below 10 per cent.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2 per cent. on the paid-up capital stock (being at the rate of 8 per cent. per annum) for the quarter.

Metropolitan Railway Co.—The directors announce that, subject to final audit, they will recommend the proprietors to declare a dividend on the ordinary stock for the past half-year at the rate of 2 per cent. per annum, carrying forward about £4,000 to the next half-year's account. The dividend on the Surplus Lands stock will be at the rate of 3 per cent. per annum, carrying forward £230. Last year the dividend on the ordinary stock was at the rate of 1½ per cent. per annum, while the Surplus Lands dividend was at the rate of 2¼ per cent. per annum.

Prospectus.—*Water Softeners (France), Ltd.* — This company, which has this week been offering an issue of 55,000 shares of £1 each at par, has been formed to acquire the patent rights for France and its Colonies of the Permutit process for the softening and purification of water.

Edmundson's Electricity Corporation, Ltd.

THE fourteenth annual meeting of this company was held on Thursday last week, at Salisbury House, Old Broad Street, E.C. Mr. P. Debell Tuckett presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, July 7th), said that the gross trading profits had increased by £2,335; dividends and interest had increased by £4,068, there was a profit of £208 on realisation of investments, and there was a new credit item of £500 under the head of Urban Co. management fee, whilst the Urban Co. guarantee was reduced by £854. On the other hand, the expenses were increased by £517, the loss on working the local authorities' undertakings was increased by £1,871, and the prior lien debenture stock interest by £208, leaving them with an increased net profit of £5,369, a result which they considered satisfactory in a year which had proved by no means favourable to electric supply undertakings generally. The item of Urban Co. management fee arose in this way. Their contract with the Urban Co., whereby they guaranteed its dividends and under which they had hitherto been working, expired on December 31st last. In January of this year they accordingly entered into a fresh seven years' agreement with that company, providing that they should continue the management of its undertakings for an inclusive annual sum of £2,000, of which that £500 was the first quarter's payment. The agreement also provided that they should carry out all new construction work at cost price, plus 10 per cent., and that they should finance the company to the extent of a further £100,000, accepting in satisfaction of such further advance either first debenture stock at market price at the date when the advance was made, or 5 per cent. second mortgage income debenture stock at five points below such price. The expenses had increased by £517, partly owing to a belated item of legal expenses incurred in connection with the creation of the prior lien debenture stock, and partly owing to the natural growth of the business. He might remind them that the expenses were reduced by £730 in 1908, and by over £1,000 in 1909, and he then warned them that the reduction has gone as far as it was safe to carry it, and that some increase was consequently to be looked for. With the extension of the business some increase in expenses must be expected if the efficiency of its conduct was to be maintained and increased. The increased loss on working the local authority undertakings was the one unsatisfactory feature of the accounts, but it was not as unsatisfactory as would appear at first sight, since £980 of the increase was due to additional interest and sinking fund charges on sums paid in respect of work carried out during the past three or four years. In order that they might clearly understand the position, it might be well for him to explain that the local authorities provided the capital for their respective undertakings, the company paying interest and sinking fund charges thereon, but it often, and indeed almost invariably, happened that a very considerable period of time elapsed between the date at which the expenditure was incurred by them and that at which payment was made to them by the local authority. During that interval the money was temporarily advanced by them, and, of course, bore no interest, since they alone were interested in the operating results. It thus came about that they might for several years have some £10,000 or £20,000 invested in these undertakings without any corresponding capital charges appearing in this particular item, until, as was the case this year, the time came for the outstanding amount to be repaid them; and then this particular item was adversely affected. Of course it made no difference to the accounts as a whole. Whilst the money was outstanding, their cash resources were depleted to that extent, and so in some form the money was bearing interest. On the other hand, when it was repaid, the capital charge appeared directly in this particular local authority item, but their cash resources were correspondingly increased. After making allowance, however, for these additional capital charges, the fact remained that the local authority towns had not done well during the past year, showing, as they did, a decreased profit of £890; but of this amount about £300 was due to entirely special losses, quite independent of the year's working, such as losses on free wiring dismantled, which would ordinarily be charged against a depreciation fund. They might have charged them against their general reserve fund, but in the absence of any special fund for the purpose, and in view of the fact that the profit balance was not distributable, and of the probability of their dealing with the whole capital position before another year, they thought it simpler to make no change in the form of the accounts this year. He had previously explained how difficult it was to avoid fluctuations in the profits derived from any individual undertaking owing to the smallness of the business, and it was a mere coincidence that this year the principal decreases had occurred in the case of the local authority towns, and so made themselves more marked. Without questioning the unsatisfactory character of any decrease in profits, he would like to point out that over all the undertakings, the total decreases aggregated £1,312 only, as against total increases of £7,642. By furnishing the full details of the results realised by each individual undertaking, there was an inevitable tendency for the shareholders to attach undue weight to one or more individual returns, whereas, if they were to form a true estimate of the general progress of the company, it was essential for them to take a comprehensive view of the position as a whole, and that, he was glad to say, was by no means unsatisfactory having regard to the fact that last year undoubtedly proved very generally unfavourable to electric supply undertakings. The gross profits on the total capital of the subsidiary companies showed a progressive increase from 4·49 per cent. for 1909, to 4·66 per cent. for 1910, in spite of the fact that a large part of the capital expenditure was incurred towards the end of the year, and brought in no return, whilst the return on capital shown in their profit and loss account had very nearly doubled in the last two years, having increased from 1·68 per cent. in 1908, to 3·0 per cent. this last year. The output had increased by nearly 2,000,000 units, the private lighting output having increased 6 per cent., as compared with 4 per cent. a year ago, whilst the power output had increased 16 per cent., as compared with 19 per cent. The lamp connections had increased by the equivalent of 107,299 33-watt lamps, as compared with an increase of 88,935 the previous year, and they would be pleased to know that this rate of increase had been more than maintained in the current year. This steady growth was a most satisfactory feature, and clearly indicated the progressive character of the business. The metal lamp was undoubtedly tending to stimulate new connections, whilst he thought they might now consider that they had felt the worst of its adverse influence on their revenue. Returning to the accounts they recommended that the year's net profit of £16,138, should with the previous balance of £25,578, be carried to reserve. They had hitherto carried the balance of net profit forward each year, but as the arrangement come to at the time of the creation of the prior lien debenture stock precluded their distributing it, and as the four years during which they had been so precluded, expired on March 31st last, the better course on this occasion appeared to them to be to appropriate this balance to reserve. He did not know whether they realised how substantially the position of the company had been strengthened during the past four years; in the first place, by this addition of £41,716 to the value of its assets, and, secondly, by the reserve against investments in the balance-sheet, which this year had been increased by £1,720, and during the past four years by £4,720. Moreover, during the past four years the reserves of the subsidiary companies had been increased by just on £100,000, the amount so set aside for 1910 being over £19,000 in excess of the provision for 1906, if they excluded Winchester, which was no longer theirs. This increase in the subsidiary companies' reserves, he need hardly tell them, represented extra profits earned over and above those brought into their profit and loss accounts, so that the progress made during a period in which they had been seriously handicapped by the introduction of the metal lamp could not be considered otherwise than gratifying. The actual growth of profits during the past four years exceeded £35,000 on an increased capital expenditure of approximately £200,000; the return on the new capital was, therefore, nearly 18 per cent. In view of the fact that they would be in a position to resume the distribution of profits next year, he thought it might be well for him to warn them against jumping to the conclusion that the whole of the net profits realised for the year would be available for distribution. In the first place, a 1 per cent. sinking fund commenced next year on both their debenture and prior lien debenture stocks. Then there was an extra ½ per cent. rate of interest payable on the debenture stock next July and subsequently as long as any prior lien debenture stock remained outstanding. Moreover, the item of gross trading profits was so subject to fluctuation from year to year, owing to the large extent to which it was dependent on the expenditure of the subsidiary companies, that it might be unwise to rely on it to the full extent, if stable dividends were to be maintained. Before, however, they had to consider the question of a dividend they would no doubt be calling them together to approve a scheme of capital reduction, on which to some extent, at any rate, the question of a dividend was likely to depend. It was, therefore, altogether premature to consider the question of a dividend now, and his only object in mentioning the subject was to prevent their being misled by false assumptions. The prospects were very much better than appeared probable a few years ago, and, so far as they could foresee, were likely steadily to improve from year to year, but it would serve no good purpose, and only create disappointment, to assume that they were better than in fact they were. On the balance-sheet there was nothing to which he desired specially to call attention, beyond pointing out that their financial position was satisfactorily strong, disclosing as it did, liquid assets of over £50,000. The item of investments and advances had increased by £38,754, as compared with an increase of £36,168 the previous year. The reserve against investments was increased by £1,720 Turning to the subsidiary companies, the deficit on the working of the Scarborough tramways had been reduced by £638. This was largely owing to their having discontinued running during the past winter. Last year he told them that the company was in negotiation with the Scarborough Town Council with a view to obtaining some relief either in connection with the upkeep of the roads or in some other direction. He regretted to say that they failed to secure any modification of the conditions under which they were working, and owing to the intervention of the Board of Trade as a result of the discontinued running last winter, they had had to give an undertaking to continue running throughout the coming winter in order to avoid the risk of having the concession cancelled. Since running was resumed in April, the undertaking had shown some improvement compared with the corresponding period of last year, no doubt largely owing to the very much finer weather, but substantially the position remained what it was. At the moment it was difficult to see what more could be done, short of abandoning the undertaking, which they were not prepared to do, but the fact remained that the undertaking could not continue indefinitely to be run under existing conditions. He could only say that the matter would receive their anxious attention, and that sooner or later some way out of the difficulty would have to be found, if the town was to continue to enjoy the advantages of a tramway service. The Lancashire Power Co. continued to make most satisfactory progress. Last year it realised a profit of £6,000, as against a loss of £3,809 two years previously, whilst this year it was expected to earn a profit of £10,000 to £12,000, enough to provide a substantial margin over the £7,500 debenture interest on

its £150,000 5 per cent. debentures. During the year terms had been arranged with the Winchester Corporation as to the price payable by them for the purchase of the undertaking, which would result in their receiving about £6 10s. per share on their 3,363 £5 shares, in addition to a premium of 5 per cent. on their £9,000 debentures, or a total profit of £5,854. Their £9,000 debentures had already been paid off, and the money had been applied in redeeming an equivalent amount of prior lien debenture stock in accordance with the provisions of the prior lien debenture trust deed. The balance of the purchase money would be paid them as soon as the Bill embodying the terms completed its passage through Parliament, which it was likely to do within the next few weeks. He had finally to refer to an important modification which they had secured in their agreements with two of the local authorities whose undertakings they worked. The agreements provided for their working the undertakings for a period of 25 years, with an option to the local authorities in each case to terminate the agreement and take over the undertaking after the fourteenth year. In other words, as long as they were working at a loss after the fourteenth year, the company were to continue to work them and bear that loss. As soon as they became profitable, the local authorities could take them over. This arrangement, he was glad to say, they had been able to modify in the case of Dorking and Hamilton; in the case of Hamilton, by entirely cancelling the option; in the case of Dorking, by stipulating that the option should not be exercised until after the twentieth year. In both cases they hoped that this would enable them to make good, or more than make good, in the later years, the losses incurred during the earlier years. It was only right and proper that they should be afforded this opportunity of making good their losses, and it was no less in the interests of the local authorities and their consumers that they should enjoy this increased security of tenure, for it would have been impossible for them to develop the business with any assurance or energy if they were liable at any moment to be deprived of the fruits of their labours.

MR. STANLEY BEETON seconded the motion.

MR. KITCHIN congratulated the chairman on the clear way in which he had put the exact state of the company before the shareholders, and said that the position was, he thought, a far more satisfactory one than any of them could have anticipated at the time when Mr. Tuckett and his colleagues took over the direction of the company's affairs. Incidentally, he had been struck by one thing in the balance-sheet, and that was that the directors only received the paltry sum of £600 a year for managing that huge undertaking. He ventured to say there was no other company in the City to-day involving such an immense amount of work and thought and such a considerable responsibility, where the directors were so badly paid. He knew it was a very bad time to talk about increasing directors' fees when the shareholders were receiving no dividends, but he did think that at all times it was desirable to pay directors in proportion to the nature of their work, and he hoped that before the next meeting they would have some suggestion either from the board or from the shareholders which would enable them to feel that they were remunerating the directors more in accordance with their deserts.

MR. H. MITCHELL said it was not remarkable that the shares which they held in many subsidiary companies were not yet giving them an adequate return on the capital—that was often the case in the early years of gas and water or electrical undertakings. He thought, however, the shareholders would desire to receive an assurance as to the policy the board would adopt in the future in reference to investing in similar undertakings. They now had a large amount of capital which was practically unremunerative. It was obvious that if the companies in which they had sunk their capital gradually became profit earning, the additional profit would be absorbed if they were undertaking new works in other districts that would have to go through a similar period of difficulty in their inception. He hoped, therefore, that except under very favourable circumstances the board would not embark on any fresh enterprises in the future. He would also like to know whether the board was in a position to foreshadow any proposals for dealing with the arrears of dividend on the preference shares. Unless some arrangement was come to with the holders of the preference shares nothing could be done. As to the remuneration of the directors, he quite realised that the board were working very strenuously for very small fees indeed, and he felt sure that when the company was put on a dividend-paying basis the shareholders would not be found ungenerous or unjust.

MR. PAXTON, as an original shareholder, endorsed the remarks of Mr. Kitchin with regard to the inadequate remuneration of the directors, and said he thought the time was approaching when the question should be reconsidered. He was delighted with the progress the company had made, and believed that with a little patience they would pull round.

MR. HEDGES remarked that while he heartily agreed with the previous speakers that the directors were not getting a very large remuneration, he thought it was their own fault. When they assumed office they took the work on at the present rate, and he was afraid they would not get any more until some settlement was made in regard to the preference dividend arrears.

MR. PAGE called attention to the fact that the additional capital expenditure put into the Urban Co. last year was £71,300, which, he said, had only produced an extra profit of £2,187, which, he thought, was exceedingly poor.

The CHAIRMAN, in reply, said that as he had said, they were making steady and satisfactory progress, and their profits this year would be increased both by the growth of the general business, which had been very satisfactory so far, and from the fact that the guarantee of the Urban Co. having expired they would derive a much larger sum by way of interest on their advances than they had hitherto derived as dividend on their ordinary shares in that company. Their arrangement with the Urban Co. was a very fair one. It was to their advantage to see the company prosper, and they were giving them the benefit of their organisation for £2,000 a year, which was less than they would have to pay if they did the work separately. It was perfectly true that the company had shown a disproportionate increase in profits last year, but that was partly due to the fact that 1910 was an unfavourable year for electric lighting companies generally. Then, again, a large part of the capital expenditure of the Urban Co. was expended right at the end of the year and brought in no return. It would bring in a return this year, and a still bigger return in the succeeding year. With regard to the remarks which had been made as to the directors' fees, it was quite true they were not well paid, and if when they undertook the job they had realised the enormous amount of work it involved he thought they would have been somewhat slow to take it on at the present figure. However, the company was in a very bad way, and he and his colleagues were greatly interested in it, and they had put their backs into the thing and had brought the company round to an extraordinary extent, and he hoped the shareholders appreciated the work. The position of the company to-day, compared with four years ago, was as black to white. With regard to the question of Mr. Mitchell, the policy of the board was to conserve their resources for the development of their existing undertakings, and not to go outside and put them into new ventures. As to the arrears of the preference dividend, as he told them last year before they commenced to pay dividends, they would have to call the preference shareholders together to see if some rearrangement of the capital could not be agreed upon. They had no definite proposals yet to lay before them, but he had no doubt that before the next ordinary meeting they would have submitted some scheme to the preference shareholders.

The report was adopted.

General Electric Co., Ltd.

THE annual meeting was held on Tuesday at 67, Queen Victoria Street, E.C., Mr. H. Hirst presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, July 7th), referred first to the great loss that their company had sustained by the death of their late chairman and managing director, Mr. G. Byng. The G.E.C. evolved out of a small business which Mr. Byng started in the early eighties. Mr. Byng at all times was a brilliant business man, a deep thinker, a thorough organiser and a hard worker. These qualities were bound to lead to success. His close attention to detail, his watchfulness of the development of the industry in general, his great carefulness, gave an imprint to the character of the G.E.C., which would not fade as long as they existed. Until 1899 he was the leader of their firm in every sense of the word. In that year a serious illness struck him, with which he successfully battled for 11 years with indomitable pluck. During that period he had to relinquish actual work, but his love for the concern he created, made him follow their steps forward closely and intelligently. He kept himself well informed of all that was going on inside and out of the G.E.C. His mature advice was sought by them and given by him on every question. His own private resources were at their disposal in time of stress, and he left a blank which it would be almost impossible to fill. It was by his request that he (Mr. Hirst) was privileged to stand in his place that day. He was satisfied that with a trained, loyal and hardworking staff such as they possessed, and with the assistance of his old and new colleagues, the G.E.C. might look confidently into the future. Several alterations and additions had been made to the board—another son of the late chairman, Mr. L. G. Byng, who had been for a number of years actively engaged in the firm, had joined the board. Mr. Ernest Byng filled the position vacated by him (Mr. Hirst), viz., the vice-chairmanship. Mr. M. J. Railing, a director since 1900, who had been nearly 20 years with the company in different departments, and who during recent years managed the Witton works so successfully, joined them at the head office as general manager. Dr. A. H. Railing, who enjoyed a brilliant engineering experience outside the firm, and who had been for the last four years his chief assistant in London, in order to add to his commercial and financial experience, went to Witton to take over the works management. Turning to the balance-sheet, the chairman said that the trading profits, £107,858, showed a healthy increase of £16,728. The depreciation was about £5,000 more than last year, not because they had discovered any particular item that needed larger depreciation, but they thought it a wise policy to depreciate even more fully in order to make them fitter in times of stress that might come, not necessarily through faults of their own. The property account now stood at £297,032. During the present company's 10 years' existence £186,000 had been written off, not taking into account the £92,000 which they appropriated this year for writing off goodwill. He thought he was not making a sanguine estimate if he valued the assets at a considerably higher figure than appeared in the balance-sheet. From the fact that they only declared 5 per cent. on the ordinary shares and put £43,615 to reserve, they would gather that the company were anxious to continue their conservative policy of strengthening the business and giving security to the preference and debenture-holders. The directors and their friends who held the greater portion of the ordinary shares were perfectly satisfied and willing to wait for a larger distribution of profits. The reserve account now stood at £202,103. This year they had been able to satisfy a long cherished wish by writing down goodwill and patents accounts to £1 which still left the reserve account at the respectable

total of £110,000. Sundry debtors amounted to £402,226, and he was pleased to say that there were no dangerous outstandings, and their reserves against all debts were so generous that that item could be taken as absolutely safe. He would say of this, as well as of the stock amounting to £340,138, that they were both very reasonable figures in proportion to the annual turnover. He now wished to say a few words about the investment account. It might seem strange that the same amount of investment should yield £7,000 more than last year, but the difference was accounted for by the successful working of the British General Electric Co. in South Africa, which was their property, and the satisfactory results of the Peel-Conner Telephone Works, in which they had invested nearly £70,000 18 months ago, and whose first financial report had recently been presented to the shareholders. The investment account consisted principally of two classes of investments:—(1) Investments in manufacturing concerns owned or controlled by them. They were all doing well. (2) Investments in separate trading companies which acted as feeders to their business, some of which had not been developed. The latter included the G.E. de France, the G.E. de Espana and the British General Electric Co. of South Africa. They had recently formed the British General Electric Co. of Australia, and the British General Electric Co. of China, and similar arrangements for India and the Argentine form at present the subject of the directors' serious study, and, he might add, even negotiations. They had found it impossible to do justice to their works through agents in foreign countries, and they thought it a safeguard to the business to so organise it that they could count on each of the companies abroad taking an output from each of the works proportionate to the territory which they covered. Those subsidiary concerns were therefore practically departments in the shape of limited companies so as to limit their responsibilities, and they were managed principally by selected members of their staff trained at the head office and works. During the last few years they had sent over 30 such men to different parts of the world, and had every reason to hope and believe that they would do well for themselves and for the company. As these companies had the absolute backing of the parent concern at home, their capitalisation was on a modest scale. Nevertheless the pursuance of the policy in the future would considerably increase the investments account. Needless to say the formation of these companies and the creation of shares had in no way benefited the profit and loss account. In these days of keen competition a firm like theirs could only prosper if it left nothing undone to increase its sales in every country and in every branch of its manufactures. They must bear in mind the variety of operations the G.E.C. carried on. The engineering works at Witton turned out every description of motor and dynamo from small motors for fans to turbo-generators of 5,000 KW. They installed lighting and power plants for tramway companies, electric light stations, mines and country houses. They equipped factories and steamships and carried on every kind of electrical engineering work for Government departments, municipalities, and all manner of trading concerns at home and abroad. In separate factories they manufactured conduits, electric light fittings of every style and period, electric light supplies, electric heating apparatus, bells, telephones, lampholders, arc lamps, switches and electric measuring instruments. The Robertson lamp still sold in very large quantities, and the Osram lamp continued its great career. At the present moment they were engaged in serious litigation for the purpose of establishing the patents of the latter which they considered were being infringed, and he was sanguine of success. The carbon works, which had been repeatedly mentioned at their meetings—the only works of their kind in this country—had, for reasons familiar to every shareholder, been a source of great loss to them in the past, but had this year arrived at the zero point. They were very grateful to the Admiralty and Government departments, who did their best whenever they could, to insist on the supply of British-made carbons, and thus had enabled them to keep these important works going. In the production of their goods were now employed between 7,000 and 8,000 workpeople and staff, and nothing but a strong footing in the prosperous and coming countries abroad would enable them and the board to weather depression at home. At present their works were fully occupied, and extensions were being carried out.

The CHAIRMAN then moved the adoption of the report, which was seconded by Mr. Ernest G. Byng.

The retiring directors were re-elected, and the proceedings closed with a vote of thanks to the chairman.

Madras Electric Supply Corporation.

MR. A. M. H. WALROND presided at the offices, Salisbury House, E.C., on Wednesday, July 12th, over the annual general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, July 7th), the CHAIRMAN said this was the first time that the accounts showed the working of a complete year since the main generating station was opened. The total expenditure on capital account amounted to £317,876. During the year they had expended £17,415, out of which £6,174 was for completing the main station, the Mylapore sub-station, the erection of workshops, &c., and £9,151 for extensions of mains rendered necessary by the growth of the business. The total under the heading of capital expenditure during the year was a little misleading, as the amount of £4,834 credited to electric fans was what they had received during the year by the sale of these fans, and had to be deducted from the total expenditure. They had sold or had hired out during the year 912 fans, reducing their stock by that number. They regretted they were not going off faster, but since the close of the year they had further reduced the stock by 381, and hoped that sales would increase more rapidly as the extension of their mains came into operation. Their receipts for the sale of current had increased from £3,862 in 1909 to £16,109 last year, and the total receipts came to £17,454. Their expenditure had also naturally increased, principally in the coal bill. The balance of the revenue account was a small profit of £28, which was carried to the net revenue account, in which account were shown the interest on loans, debentures, &c., and the dividends they had received from the Madras Tramways investment. The result was a loss of £1,041 for the year, which they had carried into the general balance-sheet. Comparing 1910 with 1909, it would be seen that the loss on working had been reduced from £7,840 to £1,041. The total amount now standing in the general balance-sheet against them in the suspense account was £11,387, which they would have to deal with out of future profits. During the year they had placed £70,800 debentures amongst the shareholders. The consumers had increased at the rate of practically one a day from 355 to 719, and the equivalent number of eight candle-power lamps connected increased from 29,296 to 75,329. The units sold had also increased from 267,568 to 1,882,787. At the last meeting, Col. Filgate said he anticipated that they would be on a 2,000,000-unit basis by the end of 1910, and he was pretty nearly accurate. The latest return they had received was for the week ended June 17th, when 48,245 units were delivered to consumers. This was at the rate of over 2,500,000 units per annum. Out of the receipts for current £11,205 was for private lighting and £4,903 for power. The number of units delivered to consumers during the current year up to June 17th amounted to 1,073,093, which indicated that their rate of progress was well maintained. The demand for current continued, and, amongst others, they were in negotiation with a firm who were proposing to take a minimum of 500,000 units of current per annum, which minimum they hoped would be considerably increased. Various Government offices and public buildings had been connected to the mains during the past year, and an agreement had been entered into with the municipality for a certain amount of electric street lighting. The board were quite satisfied with the progress the company was making, and it was really that which interested them as shareholders, as it indicated that they were supplying the population of Madras with an article they required. Without steady progress in the earning capacity of the plant they could not look forward to the future as confidently as they did. Another encouraging feature in their business was that they were attracting the native population, and they really still had the bulk of the European residents yet to secure as customers. The average cost of generating and distributing per unit, during the past year was 1·08d. Taking into consideration the way the staff had been hampered by making continual tests of machinery and boilers, experimenting with various coals in an endeavour to obtain the required efficiency out of the boilers, and bearing in mind that during the greater part of the year the contractors' men were working on the plant, and therefore the staff had not complete control, he did not think the shareholders would consider the balance-sheet or the cost of generating and distributing electricity as other than satisfactory. They were doubtless surprised at the paragraph in the report stating that certain questions between themselves and the contractors had been submitted to arbitration. They had every reason to believe last year that everything had been practically settled, with the exception of certain important items on which it was anticipated that an agreement satisfactory to both parties would be arrived at. He was very glad now that he was questioned last year as to the terms of settlement, as he then clearly indicated what constituted the principal matters still in dispute, which were as to the efficiency of the boilers and the capacity of the feeders. He regretted to say they had found it impossible to agree on these and other matters, and he would like the shareholders to understand that the board did everything in their power consistent with their interests to avoid litigation, as they always considered if a reasonable compromise was possible it would be preferable to settle rather than to have a lengthy arbitration. But matters were brought to a head when the contractors issued a writ against them, and so they reluctantly came to the conclusion that the only way to settle matters satisfactorily was by arbitration under the clause of the contract which provided for it. In conclusion, the chairman referred to the fact that the board had appointed Messrs. Merz and McLellan as the consulting engineers of the company, and said a representative of the firm had visited the property in Madras, and they would have the benefit of their advice in connection with the arbitration. They also advised the board that they were preparing a scheme which they hoped would materially reduce the generating costs.

MR. T. E. IVENS seconded the motion, and the report was adopted without discussion.

The retiring directors and auditors having been re-elected, the meeting terminated.

Continental Notes.—A correspondent of the *Financial News* at Vienna, states that the firm Deckert & Homolka Telephon Installations is to be transformed into a joint-stock company by co-operation of the Hungarian Bank and the Handelsgesellschaft, with a capital of 2,000,000 crowns.

Anglo-American Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ending June 30th, 1911, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on August 1st.

MARKET QUOTATIONS.

Wednesday, July 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	29/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£12 10	..
a Copper Sulphate	"	£20	£3 dec.
a Lead, Nitrate	"	£24	..
a " White Sugar	"	£22 15	..
a " Peroxide	"	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a " Chlorate	per lb.	5½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5 5	..
a Soda, Caustic (white 70 %) ..	"	£11	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a " Cyanide (basis 100 %) ..	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b " Wire, in ton lots ..	"	£102	..
b " Sheet, in ton lots ..	"	£120	..
p Babbitt's metal ingots	"	£38 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	6¼d.	..
c " Tube (brazed)	"	8¼d.	..
c " " (solid drawn) ..	"	7d.	..
c " Wire, basis	"	6¾d.	..
c Copper Tubes (brazed)	"	9½d.	..
c " " (solid drawn ..	"	8¼d.	..
g " Bars (best selected) ..	per ton	£71	..
g " Sheet	"	£71	..
g " Rod	"	£71	..
e " (Electrolytic) Bars	"	£69	..
e " " Sheets ..	"	£74 15	15/- inc.
e " " Rod ..	"	£62 5	5/- dec.
e " " H.C. Wire	per lb.	7¼d.	..
f Ebonite Rod	"	5/8	..
f " Sheet	"	4/9	..
n German Silver Wire	"	1/11	..
h Gutta-percha, fine..	"	8/6	..
h India-rubber, Para fine	"	4/4	2d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	46/11½	8½d. inc.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£13 10 to £13 15	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9	inc.
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d " " medium	"	2/6 to 4/-	..
d " " large ..	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/0½	..
p " " rolled strip & sheet	"	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8¾d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£189 to £190	£3 dec.
n " Wire, Nos. 1 to 16	per lb.	2/3	2d. dec.
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£30	10/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
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k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

The better feeling which has prevailed in regard to Consols and other gilt-edged stocks spread a more cheerful tone throughout the Stock Exchange as a whole. It cannot be said that business has improved to any extent, and, of course, in these dog-days nobody expects to be doing much. Still, there is a fair amount going on in several departments, and the declaration of dividends by the Home Railway Companies helps to keep alive the interest in that market.

New issues are not being received with any particular favour, and underwriters on all hands are complaining of the way in which they get left with stock. There will, however, be no complaint on the score of the new British Columbia Electric Railways issues not finding a ready home. In spite of the premiums at which the Preference, Preferred and Deferred have been offered, there are additional premiums established on the shares of 6d., 1s. 9d. and 4s. respectively. To take up the new stock, a few proprietors have been selling part of their other holdings, with the result that the company's Preference stock shows a fall of 2 points on the week.

The Metropolitan Railway Company has announced a dividend at the rate of 2 per cent. per annum, carrying forward the sum of £4,000 to the new account. This goes against a distribution of 1¼ per cent. a year ago, with £6,000 forward, and the result comes up to the anticipations of the more moderate prophets. Some people had talked of 2¼, or even 2½, per cent., and perhaps it was the disappointing of their expectations which caused the price to fall from 49¾ just before the figures were declared, to 48¾ just afterwards. Even so, however, the price retains a rise of 1 on balance, and the Surplus Land stock which receives 3 per cent., against 2¾ per cent. a year ago, has gained a similar amount. Districts have done better still, and at 28¾, after being 29¼, are 1¼ higher on the week, attention having been drawn to the substantial progress which the company is making towards a dividend in years to come on the Ordinary stock. There is considerable talk of fresh labour trouble on the North-Eastern system, which had the effect of depressing Home Railway prices below the best touched during the past few days; but, for all that, there is plenty of confidence felt in the market, and provided there are no open strikes, prices ought to improve.

The half-yearly report of the City and South London Railway makes a satisfactory showing, and to this is due the rise of 1½ in the price of the Ordinary stock. Perhaps the pleasantest part about the report is that which remarks that the increase of traffics is not due simply to the adventitious aid rendered by the Coronation, but that apart from this, the revenue shows a steadily expanding tendency. Central London Ordinary also hardened, and if the dividend announcement should be a good one, it is quite likely that the Deferred will improve.

Electricity Supply shares are almost stagnant again, and the slight interest which was re-aroused in the market earlier this month appears to have evaporated. Changes since we last wrote have been confined to small falls in the price of Edmundson's Preference and Westminster Ordinary. The quiet absorption of 5 per cent. securities is responsible for a rise of 4 in the North Metropolitan Power Supply 5 per cent. mortgages, while the 4½ First Mortgage Debenture stock of the Midland Electric Corporation is ½ higher. County of London Second Debenture put on 1, but the First Debenture stock fell 2, and it is said that the movements were caused by a holder of the latter exchanging into the former on the ground that the security of both is excellent, and that, as there is so little to choose between the first and second Debenture stocks, it is worth while to sell the higher-priced issue in order to put the money into the lower-priced at a margin of about 6 per cent. in favour of the transaction.

Mexican affairs are supposed to be settling down once more, and, as a result, the Canadian-Latin group is quietly steady. The chief feature is the demand for Mexican Light and Power 5 per cent. first mortgage bonds, which are still in the ascendant and by no means easy to buy. The company's Preferred stock has advanced a little. Canadian General Electric Common is 2 better, but Northern 5 per cent. first mortgage bonds continue flat, and are now no higher than 44, the shrinkage during the last few months having been very severe.

Mexico Tramway shares recovered a part of their dividend, and the Company's bonds are both better. British Columbia Preferred and Deferred Ordinary are both quoted *ex* rights, and the falls which the quotations exhibit are the result of this deduction. Sao Paulo Trams continue to improve, and there is a steady demand for the best-known bonds in this department. United Electric Trams of Monte Video Preference have risen over par.

The Telegraph market is still greatly excited over the fluctuations in Marconi shares. Since we wrote last the price has been down to 40s. again, from which it recovered to 45s. 6d., and retained most of the rise. The meeting takes place on the Thursday in this week, and even if the anticipations of a 10 per cent. dividend on the Ordinary should not be realised, it is thought probable that such an account will be given of the company's progress and prospects as will encourage present holders to keep their shares, and possibly stimulate further purchases. Were it not for the Marconi excitement the Telegraph market would be exceedingly quiet, for other changes are so few as to be almost negligible. The only changes worth quoting are improvements in Anglo-American Preferred and Deferred, others being very small.

The Telephone market is good. The rise of 5 points in National Telephone Deferred has restored the price to 120, the latest development in the Arbitration being regarded as in the company's favour. The Preferred stock and the Third Preference shares are both better. Rises have also been secured by United River Plate Telephone shares and New York Telephone bonds, while Chili Telephones are ⅛th easier.

The Manufacturing division remains very placid. Electric Constructions fell back a trifle to ⅛. Telegraph Constructions are *ex* their dividend, and show a nominal fall of £1, while Babcock and Wilcox Preference are ⅛ down.

Rubber shares are rather more active. The price of the raw stuff keeps firm at about 4s. 5d. per lb., and the market in the Stock Exchange, although quiet as regards business, is steadier for the time being.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 18th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord.	5	10	10	8 — 8⅝	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	11⅞ — 12⅜	..	5 13 2
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅝ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	11¼ — 11⅝	+ ⅛	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	+1	4 7 5
Edmundson's, Ord.	5	Nil	Nil	⅜ — ½	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	— ⅛	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87 xd	..	5 3 6
Folkestone	5	5½	6	4½ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7¼	..	6 11 0
Kensington & Knightsbridge, Ord	5	8	9	7 — 7¾	..	6 2 0
Do. 4 % Deb.	Stock	4	4	91 — 93 xd	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82 xd	..	5 9 9
London Electric, Ord.	3	2	2	1⅜ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅜ — 3⅞	..	6 9 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	+ ½	4 11 5
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	+4½	4 16 2
Notting Hill	10	7½	8	..	..	6 5 6
Oxford	5	7	7½	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	9 — 9½	..	5 5 3
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84½ — 86½	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2 13/16 — 3 3/16	..	6 5 0
Do. 5 % First Mort. Deb.	100	5	5	98½ — 101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	3½	⅞ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3½	2½ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7⅜ — 8⅛	— ⅛	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅞ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	+1	5 2 0
Canadian Gen. El. Com.	$100	7	7	110 —113	+2	6 3 11
Do. 7 % Pref.	$100	7	7	120 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	2	3	3/4 — 7/8	— 1/16	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86½ — 88½	+3½	5 13 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/32	..	..
Do. 6 % Pref.	1	6	6	13/32 — 9/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	— ½	4 17 1
Madras, Ord.	5	Nil	..	2⅜ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87½ — 88½	+1	5 13 0
Mexican Lt. & Power, Common	$100	4	4	82¾ — 84½	+ ½	4 14 10
Do. 7 % Cum. Pref.	$100	7	7	106½ — 108½	+1	6 9 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½ — 97½	+1½	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91	—1	5 9 11
Montreal, Lt., H. and Power	$100	6	7	173 —177	..	3 19 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	43 — 45	—3	11 2 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ — 103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	119 —121	— ½	3 6 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91½ — 93½	..	5 6 11
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108½ — 110½	+ ½	5 8 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅝	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	142 —144	+1	5 11 1
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3¾	3¾	69 — 71	..	5 5 3
Do. 6 % Pref.	Do.	6	6	113¾ — 114¾	+ ¾	5 4 7
Do. Def.	Do.	25/-	30/-	26½ — 26¾	+ ⅛	5 12 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	6⅞ — 7⅛	— ⅛	5 12 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅜ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅝	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4½	4½	7⅛ — 8	..	5 12 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	— ½	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	— ½	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	..	3 17 8
Eastern Extension	10	7	7	13¼ — 13⅜	+ ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ — 101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅜ — 11⅛	— ⅛	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	92 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2 1/16 — 2 1/16	+ ⅛	Nil.
Monte Video Telephone, Ord.	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	5 10 4
National Telephone, Pref.	Stock	6	6	105¾ — 106½	+1	5 12 8
Do. Def.	Do.	6	6	119 — 122	+4½	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	+ ⅛	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ — 103½	+ ¾	4 7 0
Oriental Telep. and Elec.	1	8	8	1⅞ — 1 1/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅝ — 1¾	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	+ ½	4 9 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101	..	3 19 3
Reuter's	8	5	5	8⅝ — 9½	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 —100	..	4 10 0
United River Plate Telephone	5	8	8	7 1/16 — 7 1/16	+ ⅛	5 0 10
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	Nil	..	2¼ — 2½	..	3 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¾ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅜ — 14½	+ ⅛	4 18 3
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4 % Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ — 102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 18th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ⅝	.	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8 — 1⅛	..	Nil
Do. 6 % Pref.	10	3	3	3¾ — 4¼	..	7 1 2
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 11 1
Central London Railway, Ord.	100	3	3	71 — 73	+1	4 2 2
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	55 — 57	..	3 10 2
Do. 4 % Deb.	100	4	4	102 —104 xd	..	3 16 11
City & South London, Ord.	100	1¾	1½	33 — 34	+1½	4 8 3
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	105 —108	..	4 12 7
Do. Do. 1901	100	5	5	104 —107	..	4 13 6
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12¼ — 13½	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	3/8 — 1	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	.. — ..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¾	2⅜	2¼ — 2⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3/8 — 4/8	..	Nil
Do. 4 % Deb.	100	4	4	74 — 77	..	5 3 11

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 18th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol.	100	1	1⅛	48⅜ — 49	+1	2 16 1
Do. Surplus Lands	100	2⅜	2⅝	69 — 71	+1	3 17 6
Do. 3½ % Deb.	100	3½	3½	92 — 4 xd	+ ¾	3 14 6
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	28½ — 29	+1½	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	101 —103	..	3 17 8
Do. 4½ % First Pref.	100	..	3⅛	89 — 91	+1	3 11 5
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5⅛	3/32 — 1 3/32	..	5 6 8
Do. Def.	1	Nil	Nil	1/32 — 1/16	..	Nil
Do. 5 % Pref.	1	5	5	3/32 — 1 3/32	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	99½—101½	..	4 8 8
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15 8
Potteries, Ord.	1	2	..	3/32 — 5/32	..	..
Do. 5 % Pref.	1	5	5	1/16 — 3/32	..	7 13 6
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	1/32 — 1/16	..	10 3 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	10/-	65 — 67	..	0 14 11
Do. Power House Debs.	100	..	4	101 —103	..	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2/32 — 2/32	..	Nil
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 2nd Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	+ ½	4 8 4
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11⅜	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	96½ — 98½	..	5 1 6
Brisbane Trams Invt., Ord.	5	8	8	6⅜ — 6⅝	+ 1/8	5 16 5
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	140 —144 xr	..	5 11 1
Do. Pref. Ord.	100	6	6	120 —124 xr	..	4 16 9
Do. 5 % Pref.	100	5	5	107 —110 xd	..	4 10 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104 xd	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	..	4 7 0
Calcutta Trams, Ord.	5	4½	5	5⅝ — 6⅞	..	4 0 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	+1	4 5 9
Cape Electric Trams	1	Nil	Nil	1/32 — 1/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102 xd	+1	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	+ ½	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	13/16 — 15/16	..	6 8 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101	..	4 19 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90½ — 93½	..	5 6 11
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½—101½	..	4 18 6
Mexico Trams Com.	$100	6	7	121 —123 xd	+ ¾	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	96¾ — 97¾	+1¼	5 2 4
Do. 6 % Bonds	100	6	6	99 —101	— ¾	5 18 10
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	+ ½	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	3/32 — 5/32	— 1/16	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 —100	..	4 10 0
Rio de Janeiro Trams	$100	2	5	115½—116½ xd	+2½	4 5 10
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	+ ½	4 18 0
Do. 5 % 1st Deb.	$500	5	5	97 — 98	+ ½	4 15 8
Sao Paulo Tram, Lt. and P.	$100	10	10	183 —186	+1	5 7 6
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	..	5	5	97 —100	..	5 0 0
Un. Elec. Trams Monte Video	5	7	7	5⅞ — 6⅜	..	5 9 10
Do. 6 % Pref.	5	6	6	5 — 5⅛	+ ⅛	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	+ ½	4 2 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	6	3/32 — 3/32	..	8 0 0
Do. 6 % Pref.	1	12	12	1 1/32 — 1 3/32	..	7 7 8
Babcock & Wilcox	1	24	26	5 9/16 — 5 5/8	— 1/16	4 13 6
Do. Pref.	1	6	6	1 3/32 — 1 1/16	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞ — 7⅛	..	6 15 7
Do. Pref.	5	6	6	6 — 6⅜	..	4 12 4
Do. Deb.	100	4½	4½	101 —103	+1	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/32 — 3/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/32 — 3/32	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/16 — 1/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	8⅜ — 9⅛	..	8 2 2
Do. Pref.	5	5	5	4¼ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	7½†	3 1/16 — 3 3/16	..	4 18 3
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	1/32 — 3/32	..	Nil
Do. Deb.	100	5	5	57⅜ — 67½	..	7 8 2

Dick, Kerr	1	5	6	13/16 — 15/16	..	6 8 0
Do. Pref.	1	6	6	1 1/16 — 1 1/32	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	3/32 — 1/16	..	Nil
Do. fully paid	5	Nil	Nil	1/16 — 2/32	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	3/32 — 7/32	— 1/16	Nil
Do. Pref.	2	7	7	1 1/32 — 2 1/16	..	6 15 9
Greenwood & Batley, Pref.	10	7	7	7/8 — 8 1/4	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8⅜ — 9	..	5 11 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12¼ — 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	106 —108	..	4 3 4
India-Rubber, G. & T.	10	10	10	11⅛ — 13⅛	..	7 8
Do. Pref.	10	5	5	10⅜ — 10⅝	..	4 15 3
Telegraph Construction	12	17½	20	35½ — 37½ xd	— ⅜	6 5 5
Do. Deb.	100	4	4	99 —101	..	3 19 3
Willans & Robinson	1	Nil	Nil	3/32 — 3/32	..	Nil
Do. Pref.	5	3	Nil	1/2 — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., March 9th 1911.

MISCELLANEOUS LAMP CHARACTERISTICS.

By M. TAPPLEY.

THE present notes are in no sense or degree intended as a complete survey of lamp characteristics, but merely comprise a collection of miscellaneous data and facts collected from many sources, during a number of years. The lamps dealt with are mainly electric, though other types are referred to from time to time.

Types of Luminous Sources Available.—It is hardly necessary to explain at length the desirability, from the efficiency standpoint, of a "cold" source of light: all heat generated by a luminous source, and stored or radiated at a lower temperature than that at which incandescence commences (700-800° F.), must be regarded as energy wholly wasted so far as the primary object of the source is concerned. What is theoretically desirable is a source emitting light without heat, and in such a case alone is 100 per cent. luminous efficiency even theoretically possible.

The vast majority of commercially successful lamps depend upon incandescence for their luminosity, and it then becomes necessary to operate at as *high* a temperature as possible, in order to increase the ratio of the luminous to the invisible heat radiations.

Thus, while ideal conditions require a low temperature, it is usually necessary in practice to go as far as possible in the opposite direction, owing to the impossibility of realising the theoretical desideratum—in other words, instead of *reducing the heat* emissions we must strain every endeavour to *increase the luminous* radiations.

The "cold" light of fluorescence and phosphorescence cannot be utilised commercially, owing to its weakness and inconstant nature. Some attempt has, it is true, been made to utilise such a "cold" light in the "transforming" reflectors used to correct the illumination of mercury arcs and similar monochromatic or strongly coloured sources. Such reflectors, when for use with mercury arcs, are coated with a varnish in which rhodamine is the essential constituent; collodion is used to "carry" an alcoholic solution of rhodamine, a little castor oil being added to promote subsequent fluorescence of the coating.

A somewhat similar luminous "source" (again of a secondary character) may be obtained by using a solution of pyrogallol and formaldehyde with 30 per cent. hydrogen-peroxide. This solution emits a comparatively strong red light, while remaining cool enough to be easily handled.

Cold sources such as the above are, at present, of little more than academic or laboratory interest, and the most hopeful means of approaching ideal conditions in a *commercial* lamp seems to be by utilising the luminescence of gases traversed by an electric current. Thus the Moore vapour lamp, employing the principle of the Geissler tube by passing a high-tension electric discharge through nitrogen or carbon-dioxide at a pressure of about 1/10 mm., is a comparatively cool source, though its temperature is still too high to enable it to attain very high efficiencies by reason of this characteristic. Similarly, the Cooper-Hewitt lamp, employing the luminescence of mercury vapour, runs at 300°-400° C., a temperature which, though comparatively low, is high enough to preclude any abnormal efficiency due to coolness of the source.

In short, no commercial source of illumination is really *cool*, and it almost invariably pays, therefore, to *increase* the working temperature of the source as far as possible in order that the increased incandescence, outweighing its own heat radiation increment, may contribute something to the reduction of the *relative* importance of the remaining thermal radiations. Thus the quartz mercury vapour lamp owes its great advance in efficiency over the ordinary mercury lamp (see Table I) to the much higher working temperature which is possible in the quartz tubes employed.

Whereas the vapour temperature in the Cooper-Hewitt lamp is probably well under 500° C., that in the quartz type is said to approach 6,000° C. in the central core of the vapour column (probably the actual temperature, though still very high, is considerably lower than this abnormal figure).

Most flame (combustion) lamps derive their luminosity from incandescent carbon particles, formed and consumed in the flame, while later and more efficient sources (other than electric) depend chiefly upon the introduction of refractory solid bodies (*e.g.*, lime or rare earth "mantles") into an intensely hot non-luminous flame. In electric lamps, besides the luminescent vapour types, we have the incandescent filament (of carbon, rare earths or rare metals), and the arc struck between solid electrodes—whether of pure carbon, impregnated carbon or magnetite or similar novel composition.

Failing the commercial feasibility, or pending the realisation, of a "cold" source, what is required is a refractory substance which will *radiate as light a maximum percentage of the energy supplied to it.* The development of rare earth

TABLE I.—LUMINOUS EFFICIENCIES.

Source.	Watts per C.P.*	Relative efficiency.†
Mechanical equivalent ...	0·08	100 per cent.
Black body at 12,000° F. ...	0·16	50
Oil lamp	70‡	0·11 per cent.
Gas burner	70‡	0·11
Incandescent gas	7—10‡	1·1—0·8
Acetylene	15‡	0·53
Carbon filament	3—4	2⅔—2
Metallised filament	2—3	4—2⅔
Nernst	1	8
Metallic filament	1—1¼	8—6·4
Mercury lamp (L.T.)	0·4—0·65	20—12
Quartz ditto	0·2—0·3	40—27
Moore tube (N_2)	1·6—1·8	5—4½
Moore tube (CO_2)	about 3	2⅔
Geissler tube	0·25	32

Arcs.§	D.C.	A.C.	D.C.	A.C.
Carbon arc: open ...	0·5 —1·0	0·75—1·5	16—18	10—5
„ in globe ...	1·3	2·2	6·25	3·6
„ enclosed, no outer globe	1·5 —2·0	1·7 —2·5	5·3 —4·0	4·7 —3·2
„ with globe	3 —3·5	3 —4·0	2·65—2·3	2·65—2·0
"Carbone" arc ...	0·84	—	9·5	—
Flame arc: vertical carbons ...	0·4	0·4	20	20
„ inclined carbons ...	0·2	0·2	40	40
Bremer arc: no globe	·12— ·20	0·23	66—40	35
„ with globe	·25—0·3	—	32—27	—
Blondel arc: no globe	0·10—0·13	0·17	80—62	47
Magnetite arc ...	0·8	—	10	—
Titanium arc ...	0·24	—	33·3	—

* Watts per M.S.C.P. is intended except in the case of tube lamps, when M.H.-S.C.P. is intended; in the arc lamp-data the higher efficiencies refer in general to M.H.-S.C.P. and the lower figures to M.S.C.P. (see also note below).

† *i.e.*, ratio of actual efficiency to 0·08 watt / C.P.

‡ Approximately, and taking full electrical equivalent (100 per cent. conversion) of the calorific value of oil, gas, &c. Approximate consumptions per C.P.-hour are:—

Candle, 110—140 grains.		Regenerative burner,	0·10 cb. ft.
Oil lamp, 55— 65 „		Welsbach „	0·07 „
Fish-tail gas burner, 0·35 cb. ft.		Ditto, after 800 hours' life,	0·1—0·13.
Argand burner, 0·30 „			

§ Certain of the exceptional figures in this section neglect the power absorbed by the necessary controlling coils, &c., in the lamps and are, even so, too high to be relied upon for general estimates. The following figures, for instance, were obtained by deducting the watts absorbed in the regulating coils from the gross consumption:—

Open	arc (10 a., D.C.),	0·4 watt / M.S.C.P.
Enclosed	„ (5 a., D.C.),	0·9 „
Flame	„ (10 a., D.C.),	0·15 „

TABLE II.—COLOUR OF LIGHT FROM VARIOUS LAMPS (Daylight taken as White).

Candle.—Very yellow, even orange.
Oil lamp.—Pale orange or decided yellow.
Acetylene.—Good approach to daylight.
Flat gas flame.—Pale orange or yellow.
Incandescent mantle.—Good approach to daylight; greenish tinge evident.
Carbon-filament glow lamp.—Decidedly yellow.
Nernst lamp.—Much less yellow than carbon-filament light.
Metallic-filament glow lamp.—Good approach to daylight; yellow tinge evident.
Open carbon arc.—Closest available approach to daylight.
Enclosed carbon arc.—Excess of blue and violet rays.
Flame arc.—White, yellow or rose, according to impregnation; yellow is most efficient.
Moore tube, CO_2.—White, nearly equivalent to skylight at 30°-40° elevation.
Ditto, N_2.—Rosy yellow or pink.
Mercury arc, low voltage.—Intense greenish blue; no red rays.
Ditto, high voltage (quartz).—Violet blue when first struck; intense yellow green when running.

and metallic filament glow lamps is typical of the utilisation of substances of very high working temperature,* also fortunately possessed of the property of radiating selectively to a certain limited extent. By "selective" radiation is meant energy radiation in quantities of various wave lengths other than would be radiated by a "black" body under similar circumstances: what is required in incandescent lamps is a selective radiator which will, at a certain temperature, radiate a greater percentage of luminous energy than is accounted for solely by its temperature (taking a "black-body" as standard). Though "cold" radiation is, at present, inapplicable to commercial high-C.P. lamps, we may yet, by aid of selective radiation, approach efficiencies otherwise unattainable.

When it is remembered that a black body at about 12,000° F. (6,700° C.) would radiate only 50 per cent. of its total energy as light, and that the theoretical mechanical equivalent of luminous radiations is about 0·08 watt per C.P. (3·34 ft.-lb. per min. per C.P.), it will be seen how limited is the efficiency which can be attained by any incandescent source of light and how far even the best of modern lamps falls short of the efficiency theoretically obtainable (see Table I).

Rating of Lamps.—The "rating" of lamps—the denomination by which their capacity, and hence their illuminating and commercial value shall be judged—is not a particularly difficult problem in the case of electric lamps other than arcs. "Old-fashioned" lamps (flame lamps, &c.) were, and are, seldom given any particular rating, but their performance is tolerably uniform† whatever the make of lamp, and is so familiar, in a rough way, that no precise rating is necessary. When electric glow lamps and improved gas burners began to be placed upon the market, however, the necessity was felt for devising a definite rating system, if only to enable a graphic description of the merits of the new forms of lamp.

Gas burners and mantles are usually rated by the candle-power they yield when new and consuming so many cb. ft. of gas per hour: such a rating is of fairly permanent value in the case of gas burners, but (as shown later) gas mantles undergo a rapid deterioration which necessitates a liberal reduction from the nominal rating in order to determine the mean useful C.P. during the life of the mantle. Similarly, the rating applied to glow lamps of various types is based upon their C.P. when new and operated upon the supply voltage for which they were designed. In the case of carbon-filament lamps, the deterioration in candle-power, which occurs before the "smashing" point is reached (see later), may be 20 per cent., hence the nominal rating again requires correction in order to yield the mean effective candle-power. In the case of metallic-filament lamps the deterioration is much less rapid and less in total amount; hence correction therefor is proportionately less important.

The question at once arises as to how the "rating" C.P. should be determined. In the early days of electric lighting, when simple filaments were common, it was usual to follow out a gas engineering convention by photometring the lamps with the plane of the filament at 45° to the length of the photometer bench. The candle-power thus estimated was a reasonable and sufficient rating basis for those days, but the complex filament shapes now employed, and the greater accuracy of working needed to discriminate between various lamps, call for a more satisfactory and widely applicable rating. Though mean spherical candle-power would be the fairest basis of comparison (as being proportional to the total luminous flux from the lamp), mean horizontal candle-power is usually accepted for glow lamps, mainly because this quantity is readily determined, and with considerable accuracy, by taking readings in a few radial directions in a horizontal central plane through the lamp. Mean hemispherical candle-power is hardly a suitable rating for glow lamps, since these are generally employed in rooms and similar spaces where upward-going light is of very distinct value. If a glow lamp is to be used with an opaque top reflector, or applied to street lighting, M.H.-S.C.P. (as determined when completely fitted for service) is, of course, a very suitable rating.

The rating of tube lamps presents difficulty only in the great and distributed extent of the luminous area; a mean hemispherical candle-power rating is most convenient for these lamps as at present utilised, and the candle-power per foot (taking the average value for a full-sized lamp) is a useful basis for estimating purposes.

(To be continued.)

* Carbon melts at a far higher temperature than the metals used in glow lamp manufacture (tantalum, tungsten, &c.), but the latter can be worked at a temperature 200°-400° C. higher than that at which carbon filaments commence to disintegrate.

† At least there is nothing comparable to the vast difference in efficiency which may exist between outwardly identical electric lamps; and differences in the grade of oil used in paraffin lamps, say, are less important than changes in the brand of carbons used in arc lamps.

ELECTRICAL TRADE WITH CANADA.

IT is now over three years since this journal dealt at some length with the question of the cultivation of electrical trade with Canada, with special reference to the report made by Mr. Richard Grigg, then Commissioner of the Advisory Committee to the Board of Trade on Commercial Intelligence. Mr. Grigg, who was shortly afterwards appointed British Trade Commissioner to the Dominion of Canada, with headquarters at Montreal, has prepared a further report, which dates down to the end of March, 1910, and which is also worthy of the careful attention of British exporters. It appears from an introductory letter accompanying the report that the work of the Montreal office is steadily increasing, as is indicated by the number of inquiries received and letters dispatched during last year; whilst, at the same time, a growing number of British visitors call at the Commissioner's office, which now has seven correspondents in different parts of the Dominion. Many conferences have occurred with the Governor-General, and numerous interviews with Ministers of the Crown in Ottawa and elsewhere have also taken place. Experience has confirmed the opinion that there exists throughout Canada a keen desire, both on patriotic and business grounds, to better understand differing points of view, and to draw closer the bonds of commercial union. Although a marked improvement has occurred in the attention given to the Canadian market by British manufacturers, the impression still remains, the Commissioner submits, that British knowledge of the Canadian market and appreciation of its great future is much less extensive than in the case of rivals in the United States.

The report, in first proceeding to deal with the economic conditions, considers it desirable to draw prominent attention to those factors of industrial and trade developments which have assumed importance since the issue of the former report, and in this connection emphasis is laid on the fact that Canada is destined to undergo a great industrial and financial expansion of a permanent character, owing to the increase in the population, the development of transportation facilities, the possession of natural water courses capable of yielding 25,000,000 H.P., and the enormous forest wealth and other resources in the country. These circumstances point to the necessity for the trader of broad views and large capacity to look to the future rather than to the present, and the Commissioner has consequently selected those essential facts which are needed for a due comprehension of the conditions and prospects of British trade in Canada. After referring to the augmentation in the population which now exceeds 7,174,000 persons, to immigration and land settlement and railway transport, the report raises the question of the development of power, in amplification of the information which was given in the former report. It is considered that the sources of power supply from the water courses are inexhaustible, amounting to 25,693,000 H.P. of which only 486,887 H.P. is utilised at the present time. A statement is given showing the rates charged for light and power in various parts of the country. Mr. R. E. Young, secretary of the Canadian Conservation Commission, estimates the consumption of coal for 1 H.P. for one year at 21 tons 9 cwt., and on this basis 25,693,000 H.P. would require 551,134,000 tons of coal for one year. The Province of Quebec is specially endowed with water courses, the power and volume of which are unsurpassed; Ontario, where a greater development of water power has

taken place, occupies the second position; British Columbia ranks third, and the Province of Alberta fourth.

The question of native manufacturers from the standpoint of being competitive with British products is next mentioned, but in the absence of new official statistics it is deemed unnecessary to repeat the information given in the former report. It is, however, considered desirable to draw attention to the progressive consolidation of capital and to the formation of large industrial undertakings by the amalgamation of a number of companies previously on a competitive basis, and it is significant of the present development of manufacturing that capital from the United States is being invested in Canada in a continuously increasing volume, and is recorded at the total of £45,000,000. In connection with the tendency towards combination of manufacturing, reference is made to a Bill passed in 1910 for the investigation of combines and monopolies which may tend to restrict competition. If the results of such an inquiry should indicate that a combine promotes unduly the advantage of the manufacturers or dealers at the expense of the consumer in regard to any article, the import of which is subjected to a Customs duty, the Governor in Council may direct that the article be admitted to Canada free of duty, or at a reduced duty. This new law also provides in similar cases for the revocation of patents issued under the Patents Act, and it likewise stipulates monetary penalties for limiting the facilities for transporting, manufacturing, supplying, storing or dealing in any article which may be the subject of trade. The report proceeds to give tables indicating in some degree the level of wages in certain important classes of labour. Thus, in the case of additions to the Post Office building at Toronto, Ontario, the electricians received 32½ cents per hour, and worked eight hours per day; and the electrical workers on the Dominion lands building at Lethbridge, Alberta, were paid 37 cents per hour for a nine-hour day. All statistics of current wages are, however, incomplete unless account is taken of the sharp increase which general prices have undergone of late in Canada, and of the enhanced cost of living thereby brought about.

After referring to the commercial convention concluded between Canada and France in February, 1910, the report mentions the termination of the surtax on German goods as a result of the provisional agreement which was entered into on February 15th, 1910. The agreement contemplates at a later date a formal convention for the regulation of commercial relations between Canada and Germany. It is submitted there is little doubt that Germany will recover much of the trade which was lost because of the imposition of the surtax, and trade thus regained will be mainly taken from that at present enjoyed by Great Britain and the United States. It is added that German firms are showing great activity and earnestness in their attempt to re-enter the Canadian market, and that if Germany succeeds in obtaining the benefit of the intermediate tariff, she will prove an extremely formidable competitor, and the utmost efforts would be required on the part of British manufacturers and merchants to maintain their position in the Canadian market. The report also discusses commercial agreements with the United States, but the observations were made before the recent negotiations for a reciprocity agreement took place.

The second part of the report treats of the import trade of Canada, particularly in regard to the keen struggle proceeding between the British and United States competitors for the possession of the trade. At present the honours of the contest are divided, not perhaps evenly, but, at any rate, in such a proportion as to show that the struggle is by no means settled in either direction, and that the balance may be turned to either side by superior efforts and greater efficiency of one competitor or the other. It would appear, in the opinion of the Commissioner, that victory in regard to really competitive goods must ultimately lie with those who best understand the conditions of the country; who can expand their business to meet the rapidly changing conditions of the Canadian market; who can foresee the directions in which a forward policy of organisation and advertisement may secure in advance markets of vital importance for the trade of coming years. It is not meant to imply that the promotion of closer trade between Canada and Great Britain must depend solely on the efforts of the British producer, as it is obvious that some responsibility also rests upon the merchants and the general community in the Dominion. At present very strenuous efforts are being made in financial and industrial circles in the United States to control, and, indeed, to dominate not only the trade, but the whole commercial life of Canada. If these efforts are to be combated, the Commissioner states that it cannot be done merely by arousing the British merchant to greater endeavours, but it must depend to some extent on the amount of co-operation afforded him by the importers and consumers in the Dominion.

The report, in proceeding to give an analysis of the existing trade situation, submits that the question of the moment is whether British trade with Canada under existing conditions has increased or declined during the past five years in proportion to that of its great competitor. It is shown in this connection that the augmentation in the total trade of Canada amounted to 93·16 per cent. in the 10 years ended with March, 1910, and an average increase of 32·2 per cent. took place in the five years 1906-10 as compared with the five years preceding. As to the respective positions of the United Kingdom and the United States, a tabular statement indicates that the share of the latter country averaged 58·68 per cent. of the total trade in value in the three years ended with March, 1910, as contrasted with an average of 59·91 per cent. in the years 1905-7, whilst the figures of the share of the United Kingdom in the Canadian import trade were 25·79 per cent. and 24·72 per cent. in the same years respectively. The report, in classifying the Canadian imports, rules British participation out of consideration in regard to (A) natural products and raw materials; (B) neutral trade, consisting of articles derived from countries other than the United Kingdom and the United States; (C) special American imports; and (D) exceptional cases, being articles not manufactured and not on a competitive basis. On the other hand, the only field with which British competitive trade is concerned is said to be class E, consisting of imports, practically all manufactured, and on a more or less competitive basis.

The special American imports included under class C comprise manufactured goods in the case of many of which the United States have an inherent natural advantage, such as carriages and electrical apparatus, or the imports of which depend upon considerations other than those of a purely commercial character; and by natural advantage are implied the peculiar conditions of manufacture, transport or sale, owing to which British competition is scarcely operative. By way of illustration, the following figures relating to Canadian imports of electrical apparatus are quoted from the report for the years in question, the values being in dollars:—

CANADIAN IMPORTS OF ELECTRICAL APPARATUS.

	1905-6.	1908-9.	1909-10.
Dutiable	3,513,714	2,073,161	3,528,504
Free	70,540	55,080	162,462
Total	3,584,254	2,128,241	3,690,966
United Kingdom dutiable ...	81,301	91,092	435,312
United Kingdom free ...	111	—	—
United Kingdom total ...	81,412	91,092	435,312
United States dutiable ...	3,391,184	1,937,371	2,998,381
United States free	69,439	54,739	162,460
United States total	3,460,623	1,992,110	3,160,841

Discussing the commodities of competitive trade, it is shown that the United Kingdom participates to the extent of 19·2 per cent. in the Canadian imports of copper in manufactured form, as compared with 77·7 per cent. in the case of the United States. The former with a percentage of 18·5 to 18·7 in iron and steel, holds its own against the United States, with from 77·8 to 78·1 per cent. As proved by a tabular statement of the imports the proportion of the dutiable import trade derived from the United Kingdom, averaged 41·3 per cent. in the five years ended with 1910, whilst that of the United States averaged 44·1 per cent. in the same period. The share of the United States in the free importation of competitive goods is larger, but even in this case the United Kingdom is not only holding its own, but has also increased its percentage from 12·6 per cent. in 1905-6, to 22·1 per cent. in 1909-10, whereas that of the United States declined from 79·5 per cent. in 1905-6, to 68·6 per cent. in 1909-10.

The general conclusions arrived at by the Commissioner from the tabular statement are that the United States

enjoy a preponderant share of the total of the Canadian import trade, and that the share is not appreciably declining, having averaged 59·07 per cent. in the five years 1901-5, and 59 per cent. in the five years ended with 1910. But if from the general field of importation there are eliminated all those different articles which can hardly be said to be on a competitive basis, a different result is found. The British share of the actual competitive trade has stood during the past five years at from 35·8 to 38 per cent., and shows no sign of declining, whilst in the competitive trade liable to import duties the British share in the five years is larger, and runs from 40·7 to 41·4 per cent., and seems to be increasing; the preferential tariff being a contributory factor to this result. Where various lines of British goods are not holding their position against American products, it is due to the failure to adapt them specially for the Canadian market, and to push the sale by those energetic methods of advertisement and personal contact in which certain rivals of Great Britain excel. But with a somewhat closer attention to methods of sale and to the particular requirements of the market, there is no reason why British traders should not share the field at least in equal proportions with the Americans.

The whole position of British trade, the report emphasises in several places, is intimately dependent upon shipping facilities. No amount of preferential duty and no alacrity on the part of British merchants can avail to hold the Canadian market if the conditions and cost of shipment are such as to militate against the supply of the market from overseas. It is, therefore, necessary for all who are interested on both sides of the Atlantic in the maintenance and extension of British trade to see that ocean freight rates are kept at a point which will not imperil the future importation of British goods. As to the difficulty of allocating classes of trade under special headings, the report cites electrical apparatus by way of illustration. The Canadian tariff imposes a duty of 27½ per cent. upon American goods of this class, as compared with 15 per cent. upon British electrical apparatus. Yet the average dutiable imports from the United States in the five years, 1906-10, amounted to $2,730,540, as against $151,297 from Great Britain, or about 5·15 per cent. of the joint trade. With such a preponderance of imports it does not appear possible at present to treat this class of goods as consisting of articles of competitive trade, and electrical apparatus has consequently been placed in Class C, or special American imports.

The question of the investment of capital in Canada next receives consideration. It is assumed that in the present struggle between British and American competitors for the Canadian market, the relative investment of capital from either country must count for much, but a great difference exists in the matter. American capital has been more particularly directed into enterprises such as are connected with the import trade of the country. On the other hand, the purchase of Government securities and municipal bonds, and even the bonds and shares of the Canadian railways—the forms which British investment has hitherto principally taken—operates less directly and immediately to stimulate trade than the investment of capital over a wide range of industrial concerns, together with the establishment of branch factories and agencies, which is the form of American interest in the development of Canada. It is calculated that the industrial investments of the United States in Canada amount to $226,800,000, and the electrical machinery works established by Americans in that country are those of the Canadian Westinghouse Co., the Packard Electric Co. and Conduits, Ltd. On the other hand, British capital investments in Canada during the five years ended with 1909 reached $605,453,000, but only a relatively small part of it had been placed in industrial enterprises. In addition, the Canadian public flotations in London during the past five years have included the British Columbia Electric Railroad Co., with a capital of £1,285,000; the Winnipeg Electric Railway Co., with a capital of £300,000; the Canadian General Electric Co., £620,000; the Electrical Development of Canada, £500,000; the Kamanistiquia Power Co., £265,000; the Montreal Light, Heat and Power Co., £710,000; the Shawinigan Water and Power Co., £700,000; the Toronto Power Co., £500,000; West Kootenay Power and Light Co., £240,000; Montreal Water and Power Co., and the Northern Light, Power and Coal Co., £411,522. The total of all the Canadian flotations in London in the five years is £98,983,000.

The removal of the surtax upon goods entering Canada from Germany, the report states, creates a new situation. It is very difficult to say to what extent it will injure the position now occupied by the United Kingdom in the Canadian market. In a great many lines of goods British manufacturers will undoubtedly be able to make more favourable prices than any German competitors would be able to do; but this is not the case over the whole range of imports, and it is considered probable that a certain loss of trade will be inevitable. At any rate, the abolition of the tax will call for renewed vigilance on the part of British traders, and will make it more than ever necessary for them to adapt their goods as closely as possible to the special requirements of the Canadian customer. The report again refers to the question of freight rates, and quotes figures showing that increases have taken place since 1907. It is thought that the rise in freight rates threatens to reach a point which, in the opinion of many well-informed people in Canadian circles, may affect the benefits accruing to British traders from the preferential tariff.

The third part of the report gives a survey of particular branches of trade. As far as mining machinery is concerned, it is held that the identity of mining conditions in the United States and Canada affords to American makers an advantage over British, especially owing to the relatively short distance over which goods sent in from the Western States have to be transported to western parts of Canada. A large quantity of hauling engines, mill engines, winding engines, boilers, &c., is made in Canada, whilst pumps, wrought-iron pipes and rails are brought in from the United States, where the large home consumption renders it possible for dealers to offer a great variety of choice at very favourable prices. In British Columbia the United States have a specially strong hold on the market for mining supplies in consequence of the facility of transportation and the ease of business communication at such a short distance from the western basis of American supply.

It is not likely that any considerable part of this trade can be diverted into British channels without special efforts in the way of despatching travellers, establishing agencies and maintaining a sufficiently large stock on the spot to be able to deal with all questions of breakdowns and repairs without undue delay. This point was emphasised by Mr. C. Pepper in a United States Consular report, who submits that the chief reason for American firms being so successful, both in the east and west of Canada, lies in the keeping of large stocks in all the principal distributing centres, and in having competent and well-informed travellers constantly on the road. For instance, two large American firms in the machinery trade have agents with large stocks at Vancouver, Winnipeg, Nelson and Montreal, with travellers frequently visiting these points.

The British Trade Commissioner, in conclusion, adds that a large and growing business awaits those English houses which will show sufficient enterprise to adopt the methods suited to the needs of the country, methods which in many instances may be totally different from those to which they have been accustomed.

Coronation Festivities at Shanghai.—Electricity seems to have had a very large part to play in the enthusiastic Coronation rejoicings at Shanghai. On the night of June 22nd, the maximum load on the municipal generating station, including traction, was 4,200 KW., or, say, 5,600 H.P. The normal load during the month of June this year, was about 2,820 KW., so that it will be seen what a very largely increased demand the station had to meet. For temporary illumination the equivalent of 36,654 30-watt lamps were connected. To provide for this extra number of lamps, the bulk of which were connected on the Bund and vicinity, 5·4 miles of cable were used by the electricity department. Additional transformer capacity was provided in temporary substations to the extent of 668 KW. The units generated on June 22nd were 34,728, as against a daily average of 22,000 during the rest of the month. Lighting and power accounted for 24,139, and traction for 10,589. It is impossible to say how many additional units were sold for lighting, as some of the temporary lamps were fed through consumers' house meters. For those temporary installations where special meters were installed, the extra units registered totalled 8,950. All the plant in the station was working, with the exception of the two Howden-Siemens turbo-alternators which are not yet in commission, and some of the machines were carrying substantial overloads.

THE PLUMBED JOINT AND BONDING.

BY WALTER E. ROGERS, A.M.I.E.E

CONSIDERING how the advantage of the plumbed joint for lead-covered street mains is appreciated in many quarters, and that it has recently been very much in evidence in connection with high-tension work, it is a matter of surprise to find that it is not universally adopted for all underground lead-covered cable joints.

Why should the cast-iron box still be found on many of the smaller low-tension networks? I am inclined to think that the real reason why some undertakings continue to use cast-iron is the fact that plumbing does not form part of our usual Technical College course, and beyond knowing how to sweat a thimble on to a copper conductor, the average station or mains man has a very vague notion as to how to wipe a joint in lead. Those wishing to learn the process, should commence wiping practice joints with the aid of a blow lamp, and when proficiency has been gained with the lamp, discard it and try without. The metal, or plumber's metal, as it is called by the man who comes in the winter to repair your burst water pipes, consists of, roughly, two parts lead and one tin, rosin being stirred in as the metal melts.

Each individual plumber prefers some slight variation from his neighbour, and one man will do good work with metal which his neighbour will say is too fine or too coarse, fine meaning too much tin, whilst too coarse means the opposite or too much lead.

When lead sleeves plumbed over the insulated joint were first introduced, the plumber-jointer did not exist. When the jointer had finished the electrical side of the job the man of burst-water pipe fame was sent for to plumb the sleeve. If the sleeve had been slipped on over the cable before the joint was made, the plumber had to draw the sleeve into position, and dress down the ends, *i.e.*, hammer down the ends of the sleeve with a piece of wood, called a dresser, till each end formed a sloping cone to the surface of the cable sheath. He would then apply with a brush the plumber's soil or black, which consists of lamp-black glue, a little size, and sufficient water to make the mixture suitable for application with a brush when warm. This soil or smudge should be applied to all surfaces where it is desired that the plumbing metal should not adhere. With a shavehook, the lead of the sleeve and the lead of the cable sheath to which it is desired to plumb should be clean scraped, each stroke of the shavehook covering or lapping the previous stroke, the sleeve being held in position by a light portable plumber's pipe vice.

Our friend then proceeded exactly as he was in the habit of doing with a water pipe, the finished joint appearing with a large swelling at each end. The sleeve was water-tight, and what a plumber would call a good sound job.

Not so the electrical man who had had experience of this bulky work. The tendency with the plumber, pure and simple, is almost invariably to use more metal than is necessary, and unless the finished joint is handled as gently as you would a gas mantle, the lead of the cable will part or crack just where the plumbing finishes off on to the cable sheath. On contract work, where all is rush and hurry and "do it cheap," one has little time to put a highly-skilled, velvet-fingered man into each joint pit to cleat the cables up. Frequently these same joints are left to take care of themselves once they have passed the specified test, and in later days many joints have had to be remade owing to lead ruptures when attempting to straighten things out a bit. This applies more particularly to small joints, such as pilot cables, &c., but it is present in all purely plumber-made joints. I have known a joint on a ·2 sq. in. single conductor cable break down, owing to its own weight, some 10 years after it was made.

Traffic vibration naturally assists the above action; therefore, dispense with the borrowed man and train your own plumber-jointer on the following lines: Use light lead soil pipe for your sleeves, say about 4 or 5 lb. lead. As the only object in a sleeve is to provide a watertight case over an insulated joint, there is no object in using heavy lead, as the extra mechanical protection secured by thick lead is not appreciable, and so not worth considering. In fact, there is no object in using lead thicker than the normal sheath thickness of the cable.

The plumbing metal as obtained from the ordinary dealers in various parts of this country differs greatly, for which reason I recommend every man to mix his own; he will then speedily come out as an efficient plumber, and be able to rectify such metal as comes into his hands, and will, in a little while, gain such dexterity as to be quite independent of bought metal:—Melt in a metal pot some 2 lb. of ordinary solder, as procured from any ordinary firm of local repute; add to this when molten, say, a $\frac{1}{4}$ lb. or $\frac{1}{2}$ lb. of lead stripped from scrap cable; add rosin freely, and stir with a piece of dry wood as the metal runs. When nicely fluid take a small previously heated ladle full of the metal, and pour some of it on to the dry pavement or floor. As the metal sets, small stars or spots, blurred as to outline, or sometimes fairly clear, appear on the surface; these same stars or specks also appear brighter than the remainder of the surface, and indicate the presence of tin. When holding the cold metal obliquely to the eye, the surface will appear somewhat mottled. Nothing but practice will tell you whether the metal is too fine or too coarse. But very roughly, if the mottling or starring of the surface is as regular as the currants in an ordinary bun, the metal is near enough for practical purposes. Now run your metal into sticks or bars roughly resembling sticks of tinman's solder as usually bought.

Turning now to the cloths for wiping joints, these should be several in number, varying in size from, say, 2 in. × 4 in. to 4 in. × 6 in., according to the dexterity of the operator, and four to six thicknesses of moleskin—not the skin of the mole, but the cloth known as moleskin. Into these moleskin pads or cloths, as they are called, rub tallow whilst the cloth is hot. When not in use, these same cloths should be kept in a more or less dust-proof tin box, and they should always be warmed and suppled before one commences operations. Sewn seams should be avoided on the working surface of the cloth.

When we have gained sufficient experience to know that the metal is about right, but it is found that the metal hangs or shows a tendency to stick to the cloth, probably too much tin is present, and often a little chalk rubbed on the cloth surface will remedy the trouble. When the sleeve and cable have been scraped clean, as already described, with the aid of a blow lamp melt some of the plumbing metal on to one end of the sleeve at the point where it is desired to wipe the joint, then with the blow lamp in one hand, and the cloth in the other, proceed to work the metal round the joint, adding more metal as you go.

A good way of applying the smudge is first to clean the surfaces to be plumbed; then take a clean piece of linen tape about 1 in. broad, and lap it once round the part to which one wishes the metal to take. Holding this tape with one hand, whilst with the other you apply the smudge, a clearly defined line is produced where the soil ends and the bright part to be plumbed commences; this indirectly greatly facilitates the plumbing operation, by ensuring a neat finish. Of course, care must be observed not to touch the clean lead with the fingers when applying the tape.

Generally speaking, if the smudge shows a tendency to blister or flake when heated, too much size is present, though greasy matter will produce a similar result. When experience has been gained, nothing but the wiping cloth should be used to finish a joint neatly; no file, rasp, or emery cloth should be used. Having finished wiping, and whilst the plumb is still hot, rub it over with tallow; this produces a very soft finished appearance to a well-made joint. When plumbing lead, tallow is the only flux used.

Having now presumably finished our plumb, the next thing is to fill the sleeve with some form of insulating compound, the electrical portion having previously been insulated with tape, paper, or mica, or any combination of these materials. Two straight cuts are made longitudinally in the top of the sleeve at each end, just clear of the plumbing, but approximately above the points of least diameter of the insulated electrical joint. Depress one side

and raise the other of each cut so as to form a lip or aperture through which, with the aid of a small enamelled iron funnel, to introduce hot filling composition.

Here it may be well to say a little as to filling compounds. When the above type of joint was first introduced, oil, of the resin oil type, was exclusively used for filling, and very good results were obtained for many years. But it must be remembered that oil will take up moisture; also oil does not tend to prevent a joint being crushed to any appreciable extent.

It is now generally admitted that it is better to fill a joint sleeve with a good quality of bituminous compound which sets hard, but becomes sufficiently fluid under the influence of heat, to ensure its running in the sleeve and so filling the interstices of the insulated electrical joint. When cold, this compound affords considerable resistance to any crushing the sleeve may be subjected to, and should the sleeve be at any time punctured, water will not get in and the compound will not get out as readily as oil would. Also, when a navvy stands on a compound-filled joint, it does not so readily crush up as the oil-filled specimen does.

One disadvantage of the compound-filled joint is the fact that as the compound cools from the outside, shrinking takes place, very much as cast-iron behaves in the foundry, *i.e.*, hollow spaces tend to form which, in an absolutely impregnable substance, would be in a state of perfect vacuum. In practice they are filled more or less with air; this matters little or nothing in low-tension work, but is a serious matter on H.T. or E.H.T. joints.

Many engineers still favour oil for filling purposes. When pouring in the oil or compound, the sleeve should be kept warm with the blow-lamp, and preferably the joint should be slightly inclined during the filling process in order to allow the air inside to be displaced as the filling compound runs in. When no more compound can be got into the joint, and bubbles have ceased to appear, the filling cuts should be dressed into their original pre-cut state, and soldered up. One small point in favour of oil as a filling is that, if the plumbing is defective, oil will in time make its appearance at the outer surface of the joint, and personally, I have more than once averted trouble by detecting oil where it should not be. Again, when the now almost universal paper-insulated cable was introduced, frequently the impregnation was of a very elementary character, and the paper would be crying out for more oil, which it would often take from our newly made joint.

Quite recently I came upon a piece of triple-concentric paper-insulated cable. The inner was ordinary seven-strand conductor, the middle was made up of segmental conductors of a beautiful mechanical fit—so much so, indeed, that the intervening paper might well have been utilised for cigarette manufacture.

Turning now to the question of bonding. Every man, however remotely connected with street mains encased in metal in one form or another, knows that the metal covering should be bonded. How many men really consider that their cable sheaths, armouring and troughing should be as electrically continuous as the revenue-earning copper conductor which it surrounds. Yet the object of bonding is to give your lead or armour a good path for carrying current, however objectionable the said current may be. If you do not provide a good path for the steady current it will take such a path as it finds, and in doing so it will corrode, burn and destroy your lead or armour.

There is absolutely nothing to say about bonding in relation to the plumbed joint, as, if properly carried out, it is as near perfection as we are likely to get in this 20th century. Practically all supply authorities, for service connections, use a cast-iron box, either with or without screwed and plumbed glands.

This sounds very nice, and so far as the plumbing goes it is, but the other end is the invention of a very inferior individual to Archimedes. The thread in the cast-iron, into which the gland screws, is frequently painted, to say nothing of the application of red lead and jute, just to make it watertight, and even if initially all that could be desired in so far as Ohm's law applies, time, moisture and temperature variation, to say nothing of vibration, soon destroy its right to the name conductor.

Many boxes I have seen, even on H.T. work, simply have an annular groove at the end of the gland attached to the box, which groove fits into a reverse groove in the box casting, the compound with which the box is filled actually forming an insulating film between box and gland. The commonest of all types of box, either disconnecting or service, is equipped with wood bushes, either impregnated with some form of creosote, or boiled in paraffin wax. If the bushes are of fairly hard wood, so far as they are concerned, the above treatment appears fairly efficient, but as nothing lasts for ever, and these same bushes are in contact with the lead sheath, and possibly armouring as well, moisture and the atmosphere always being present, shall we not in time find our lead, &c., being acted upon by vegetable acids and salts as decomposition takes place?

Split unglazed porcelain or earthenware bushes, designed as a slack fit, and previously plunged into hot or liquid compound will, I believe, ultimately be universally used. The object of the plunging in molten compound is to thicken up the otherwise too small half bush, with a non-corrosive, yet pliable insulation, roughly analagous to the Stamford joint on the Sykes conduits of the Albion Clay Co.

Some makers of boxes, fix in the box, adjacent to the sealing glands, a piece of copper tape, which is efficiently screwed to the box, but has to be soldered to the cable sheath on the site. As this is the last operation prior to filling up with compound, can one wonder that the necessary soldering is frequently skimped. Compound will cover a multitude of sins.

Some engineers will not use the copper tape as above noted, and prefer to bond externally with copper wire, coupling up each lead sheath and armour with the box. In principle this is right, but as carried out in practice it usually combines all the bad faults of any and all methods of bonding.

To begin with, my brethren, who have not had the fortune or misfortune to burn their fingers with molten solder. To the practiced hand, nothing is easier than to do soldering, such as is required for mains work, so that to the eyes of all but the soundest practical men everything appears good and sound, whereas not a single joint has really taken. So with the copper wire bonding, where solder is generally melted either with a copper bit or a blow lamp, and is allowed to do little more than flash on to the part which should be lasting in soundness as regards continuity. I know a whole town bonded on the above lines, and the first time the man who knows a sound job gets into a joint-pit and pulls at the bonding wire it will come away in his hands, showing below it evident signs of corrosion, and sometimes actually melted lead sheath.

Lead strip, cut from sheet lead and doubled where necessary, is the only suitable material for bonding lead cables. Lap it once round each lead sheath external to the cast-iron box, and do not do any amateur soldering, but honestly plumb it or wipe it on to each cable sheath, so that it makes a jumper, or completely bridges the service-box. Join one of the bolts of the cast-iron box to one or two bare copper wires; the opposite ends of the said copper wires being taken to and plumbed or wiped in with one of the bonding joints proper. Of course, care must be taken to ensure the lead bonding tape having sufficient sectional area to enable it to carry any current it may be called upon to deal with, as I have known cases where the fall of a live wire on the local tramways has caused the bonding strip to blow as if it were a fuse.

When L.T. cables are armoured, the armouring generally takes the form of steel tape, and this should be electrically continuous throughout, like the lead sheath. What is widely admitted to be a very efficient method of bonding the above type of armouring, consists of unlapping sufficient of the steel tape each side of a joint or service box, so that opposite lengths of cable armour may be lapped, punched or drilled, and a small bolt used to hold all together; then the surfaces, having been previously rendered scrupulously clean, and preferably tinned, the whole should be sweated or soldered up solid.

Painting exposed armouring at jointing or bonding points with hot compound will be found advantageous, as in a great measure preventing the corrosion and destruction of that portion of the armouring which has been unlapped from the cable, in order to secure a sufficient length for bonding. Wire-armoured cable, such as is frequently employed on H.T.

cables, should be bonded by a special clip, as shown in fig. 1, which is a part section through a joint on an armoured cable of the above description, which has proved very satisfactory in practice.

The flanged cones A, A are of cast-iron, split in a horizontal plane, the two halves of the cones forming a butt joint similar to the butt of the brasses in a high-speed engine cross-head. The provision of, or rather the use of, a butt joint ensures that as the outer flanges B, B are pulled up, the cones A, A do not pinch the lead cable sleeve or sheath.

The upper part of the figure shows opposite bonding clip cones connected by means of a wrought-iron side rod; whereas the lower half of the figure shows the flanges held together by bolts, the whole being electrically connected by a copper bond, either flexible or solid. I have used a piece of trolley wire before now, the ends of which were hammered out flat and drilled prior to use. If wrought-iron side rods

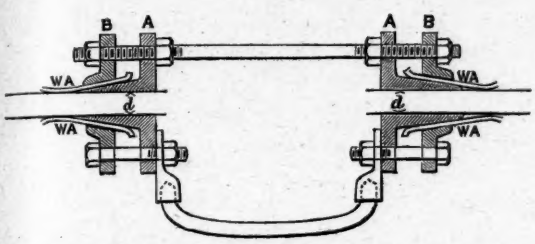


Fig. 1.—Special Bonding for Wire Armoured Cable.

are used, at least two must be employed, and preferably three or more; these rods should have as large a diameter as possible, consistent with bridging the intervening lead sleeve, which is not shown in the figure; ½ in. rods are the smallest that should be used. Flanges A, A should be notched or toothed to receive the side rods, whilst flanges B, B must have drilled holes, and these same flanges should be slipped over the cable before the joint is made. For B B flanges I have frequently employed ordinary gas flanges, the thread having been removed in a lathe and a cone formed where the thread was obliterated. The whole of the bonding fittings should finally be thickly coated with hot compound. The above method of bonding will be found infinitely superior and more lasting than any form of saddle clip arrangement.

INSULATION OF GAS-ENGINE DRIVEN GENERATOR WINDINGS.

By A. P. M. Fleming, M.I.E.E., and R. Johnson, A.M.I.E.E.

With the increasing application of gas-engine driven generators, insulation troubles peculiar to these machines are receiving more and more attention. That such troubles are still experienced is due mainly to an entire misconception of the root cause of the failures.

The opinion generally held is that the chemically active fumes from the gas engine attack the insulating materials on the windings and destroy their protective value, and this has led to the extended use of special acid-resisting varnishes on all exposed portions of the windings.

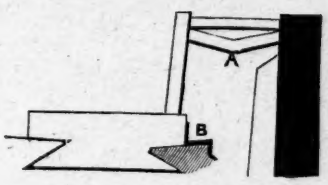
From the fact that practically all the troubles experienced occur on direct-current machines, it is clear that other factors have to be taken into account.

A number of insulation failures on gas-engine driven machines have been investigated by the writers. While in some instances the insulating coverings, particularly the varnished surfaces, have been attacked to a slight extent, no cases of breakdown traceable to this cause were found.

Trouble is first indicated by a gradual reduction of insulation resistance. Finally the windings become grounded, due to surface creepage and burning. This invariably occurs on the commutator end of the windings and can be traced to the formation of a conducting surface from the commutator to "ground." The surface creepage usually takes place from the commutator necks across the under side of the insulated ends of the coils to the armature iron, though occasionally "grounding" may occur over the commutator bushing. The two paths are shown at A and B respectively in the figure below.

If the trouble is taken in hand in time, a thorough cleaning of the surfaces affected is sufficient to restore them to their original condition, as shown by a high insulation-resistance measurement.

In an actual case, the insulation resistance of an armature, taken over a period of three months only, fell from 10 megohms to less than 0·1 megohm. In the latter condition a voltage of 250 applied directly between the windings and the armature iron was sufficient to cause a leakage and burning across the taped ends of the windings for a distance of 8 in., which, under normal conditions, would be



good for thousands of volts. That this deterioration was due solely to the accumulation of conducting deposits, and not to chemical action on the insulation, was shown by the fact that merely cleaning the surfaces was sufficient to restore the insulation to its normal condition. An insulation resistance was then obtained in excess of 10 megohms, and a pressure test of 2,000 volts was applied without causing any creepage.

The conducting deposit is formed by the action of fumes on the wearing surface of the commutator, the sulphide or other salt formed being worn off by the brushes, and, together with carbon dust, carried by windage on to the surfaces already referred to.

Failure may be prevented by frequent cleaning, the insulation resistance of the winding not being allowed to drop below a certain minimum figure. Usually, however, the affected surfaces are very difficult to get at, and the cleaning becomes an expensive and tedious undertaking. The difficulty of cleaning is frequently increased by the presence of an oil film, which causes the deposit to adhere to the insulation, and renders an air-blast practically useless.

Attempts have been made to obviate the trouble due to this deposit by heavily varnishing the commutator necks and also the armature iron, this being done in the case of small armatures by completely immersing them in varnish. In service, however, the expansion and contraction is sufficient to crack the varnish film just where the protective value is most needed, *i.e.*, where the coils leave the slots.

A drastic, but efficient, remedy is to completely house in the generator and provide a pure air supply. This, however, is expensive and cannot always be arranged. It therefore becomes necessary to prevent the deposit having access to the windings. This can be done by entirely enclosing the windings at the commutator end, or by so designing the armature as to create a draught from the rear end of the machine. The first of these alternatives has the great disadvantage of destroying ventilation, and for this reason is comparatively seldom adopted on large units.

Another remedy which has proved eminently satisfactory in practice is to break up the exposed under surfaces of the winding by means of insulating barriers so arranged as to prevent the formation of an unbroken layer of conducting deposit.

In all cases it is desirable thoroughly to fill the insulating tapings and provide a smooth glossy surface so as to afford as little lodgment for dirt as possible. Other than in this respect it is not necessary to use any special kind of insulation on gas-engine driven generators.

While the trouble is mainly confined to armatures, field coils are also sometimes affected where surfaces are depended upon to any large extent for insulation.

Troubles such as the above are by no means confined to gas-engine driven generators, but are likely to occur on machines subject to any chemically active fumes such as those met with in alkali works or in the vicinity of gas-producer plants.

THE MUNICIPAL ELECTRICAL CONVENTION, 1911.

Purchase of Fuel.

A DISCUSSION on this subject was initiated by MR. C. E. C. SHAWFIELD (Wolverhampton), who pointed out the increasing importance of fuel costs, with the rapid improvement in generating methods. A determining factor in fuel purchase was the relative situation of the plant and coalfield. It did not pay to buy coal of less than 13,000 to 14,000 B.TH.U. calorific value if the plant was far from the coalfield. Another factor was the class of furnace and stoking apparatus; mechanically-fired boilers could use inferior fuel, as the loss of combustible contents in cleaning was of small value. The percentage of incombustible contents in coal was important; the effect of the ash and clinker was much more serious than moisture, as drawing red hot clinker meant an entire waste of heat, while steam gave up some of its heat to the boiler. As regards washed and unwashed fuel, as the result of experiments carried out, he found that 1 lb. of unwashed pit bank sludge had a calorific value of 9,500 B.TH.U.; the moisture content was 5 per cent. and the ash content 28 per cent., while the price including carriage was 4s. 5d. per ton. Allowing for heat lost, ash and clinker, the commercial calorific value was 290,000 B.TH.U. per 1d. The same fuel when washed showed a calorific value of 11,700 B.TH.U. per lb. of fuel, with moisture 13 per cent. and 11 per cent. of ash. The cost was 5s. 6d. per ton, and the commercial calorific value came to 350,000 B.TH.U. per 1d., showing an appreciable gain in the latter case. A South Staffordshire pit used a simple washing apparatus consisting of a wooden trough, 12 in. deep and 12 in. wide, and from 50 to 100 yds. long, set at a gradient of 1 in 30. The fuel was fed in with water and the shale was deposited in the first 30 yds.; afterwards came comparatively clean fuel, the best being at the lower end. The fireclay was carried away in suspension. The trouble was that this fuel often contained 25 per cent. of moisture when delivered. In the Midlands he thought it best to purchase direct from the colliery, and this ensured a fairly regular grade of fuel. The practice of making a contract for a definite quantity, rather than for a fixed time, seemed much the best. It was difficult to purchase fuel on a heat unit basis through agents, but a contract could be entered into based on the net commercial value of fuel as it left the pit; something similar was done by the L.C.C. tramway authorities, who, however, based their contracts on coal as delivered. In Wolverhampton they took regular daily tests of fuel delivered; the apparatus originally cost about £10, and there was a yearly cost of some £25, but it had certainly saved them £500 a year in running costs.

MR. R. A. CHATTOCK (Birmingham) said that those stations near pits had to get their coal from the latter. He didn't entirely agree that ash heat was all lost, and it might be that unwashed coal was better than washed. With washed coal there was a good deal of moisture which tended to corrode economiser tubes. When placing a large contract he found it better to deal through an agent; the price was generally lower, as the agent could purchase on better terms and from a wide range of pits. While he quite agreed as to the value of the calorific basis, it was not the only factor to be considered, as fuels of similar calorific value gave varying results under the boiler. At Birmingham there was a testing department, and both laboratory and boiler tests were carried on continuously. It was a rule to test two ordinary boat loads and one "trial" boat load of coal each week, and they now had complete information of 130 different classes of coal in the Birmingham district, and, as a result, had reduced the average cost of fuel from 8s. to 6s. 10d. per ton, and decreased the ash content as well. The cost per unit for fuel had dropped in three years from ·18d. to ·14d., a decrease of 22 per cent. The average thermal efficiency of the boiler house plant over 24 hours was 65 per cent. The total cost of the coal burnt last year was £23,500, and the cost of the testing department came to 1·7 per cent. of that amount. In conclusion, he pointed out the necessity of obtaining coal suitable for the local conditions, and urged that for this purpose a system of testing was preferable to purchasing on the calorific basis.

MR. FRANK NEWINGTON (Edinburgh) said he found no advantage in cost when purchasing dry fuel, and unless everybody bought on the calorific basis, there would be no gain in that, as the price would be raised to those who did. In Scotland it was usual to deal through agents, and this was an advantage in case of a strike. Calorimeter tests were not reliable, and the boiler house test was better.

BAILIE WILLOCK—speaking both as a coal agent and coal master, "anything to make money," as he put it—urged that it was better to deal through an agent, whose knowledge of the business was of value in case of strikes, &c.

MR. FRANK AYTON (Ipswich) said he found that opinion on the London Coal Exchange was unfavourable to purchase on a calorific basis, as the handling of the fuel and variations in seams were beyond the merchants' control; so the merchant added a margin for contingencies, and the price went up. The colliery owner wouldn't bother about any new system as long as he could sell coal as it was raised. On the subject of coal specifications, an interesting contrast was shown by the L.C.C. Tramways Department and the Underground Railway Co., each of whom purchased about 150,000 tons per annum. The former had a specification covering 11 pages, and the latter one of 159 words on half a sheet of foolscap. At Greenwich they certainly sampled coal, but by the time it was fully tested according to specification, the shipload was half consumed. The Underground Railway engineers at Lot's Road had discarded the calorimeter in favour of the Berthier test, which took only 20 minutes, and could be carried out before the coal was unloaded from the barge. The Berthier test, to which we refer in our leader this week, is as follows: Weigh out 1 gramme of finely powdered dry coal. Mix this with about 60 grammes of lead oxide (litharge (PbO) free from silver). Also mix, say, 15 to 20 grammes of glass powder (coarse). Put this in a Battersea clay crucible, and cover with a layer (tablespoonful) of common salt, and heat in a forge fire or otherwise for about 20 minutes at a bright red. When cold, break crucible and extract the lead button from the bottom, clean off slag, then weigh and multiply its weight in grammes by 483. This will give the calorific value of the coal in British thermal units per lb. The constant 483 is worked out from the atomic weights and calorific values of the various constituents of the coal. The speaker considered that it was necessary to test continuously, and found it best in his case to purchase through London firms.

MR. H. FARADAY PROCTOR (Bristol) said some years ago he was unable to get any South Wales or Bristol coal owner to tender on the basis of calorific value.

MR. E. E. HOADLEY (Maidstone) gave his experience a few years ago, when he sent selected samples from barge loads of coal to three laboratories, and the results from the same kind of coal differed widely; also the same calorific value fuels gave varying results under the boiler. After a year's experience he gave up the idea of purchasing on a heat unit basis, and now bought on the result of boiler house tests, of which records were kept.

The PRESIDENT (Mr. John Christie) said it was the practice to test each shipload of coal received at Brighton, and to watch its performance under the boilers.

MR. SHAWFIELD, who replied briefly, admitted the influence of the tester on individual results, but considered that with the same tester the results would be comparable.

Street and Shop Front Lighting.

MR. A. H. SEABROOK (Marylebone), who opened a discussion on the above, dealt with the latter part of the subject, and particularly with the competition of high-pressure gas lighting. At West Ham an inclusive hiring charge of £2 1s. per quarter per 500-watt arc was charged, and this paid after two years, but the gas company had now introduced a competitive scheme. He found that in the adjoining area of East Ham, where a lower price was charged than in West Ham, numerous high-pressure gas lamps had been introduced, while in the latter area, the gas lamps were, if anything, being displaced. As the same gas company supplied both areas, he came to the conclusion that West Ham's advantage was derived from its business-getting department, and that price was not the all-important factor. In Marylebone, higher charges were necessary, and at 3½d. per unit it was possible to supply four 1,000-C.P. direct-current arcs for £30 per annum (900 hours). The gas company charged 25s. to 30s. per quarter for a 1,000-C.P. gas lamp. A new 4½-ampere flame arc now on the market could be supplied at an inclusive charge for energy, trimming, &c., of £5 per lamp per annum (900 hours), and gave 1,200 C.P. In conclusion, he said he had no sympathy with the idea of co-operation between the electrical and gas interests. The gas industry was much better organised, and the electrical industry could not afford to give them an inch in any way.

MR. HAYDON HARRISON, dealing with the question of street lighting, said he had come to the conclusion that, given an equal start, electric lighting would be less costly than gas lighting; but the conditions were that gas lighting had to be displaced, on which practically all the capital charges had been paid off. The electrical suppliers, on the other hand, had had great obstacles to contend with; in some cases they had not been allowed to borrow for street lighting, and in others a period of only five years was allowed for repayment of loans; but despite the high capital charges, it was possible to compete with gas. If the ordinary loan periods were allowed, it would be possible to give 50 per cent. more illumination for the same price. He pointed out that only 70 arc lamps had been removed in Westminster, and half that borough was still electrically lighted, the other half remaining gas lighted as before. This small turnover to gas (due to special reasons recorded in our pages at the time) provided the gas people with a great advertisement, and the electrical suppliers decided that this should not occur again, and consequently tendered lower than the gas company when the Holborn contract came along. The speaker explained the position at Holborn (full details of which appeared in the ELECTRICAL REVIEW), which led to a joint electric-gas tender being put in, and which, in his opinion, was preferable to a competitive tender at unremunerative rates. The standard specification which was being proposed for street lighting would almost certainly be based on the minimum illumination, and to provide this, the most effective units were between 100 and 500 C.P. The 100-watt tungsten lamp in the old lantern in dark back streets, gave by far the best result. Greater candle-power would be obtained by grouping 100-watt lamps, and an efficiency of 1·5 C.P. per watt was possible. At prices of 1½d. to 1d. per unit, the prices for such lighting were about equal to those for gas, excluding capital charges. He drew attention to the importance of having at least a share of the street lighting, if only for advertisement purposes.

MR. J. R. DICK urged that the use of ordinary gas lanterns for electric lighting was not a good advertisement for electricity; a good distinctive bracket and lantern could be obtained for about 30s. to 35s. He thought the attitude of the Local Government Board to electric street lighting was indefensible, and as regarded short loan periods for such work, he pointed out that some of the Brighton

fittings had been in use 14 or 15 years. He thought the I.M.E.A. should take the matter up with the Local Government Board. The case for automatic switching would be very favourable if a good reliable time-switch, costing 25s. to 30s., were obtainable; at present they were too expensive.

MR. S. J. WATSON (Bury) said he had adopted group lighting, using three 300-C.P. (and some 200-C.P.) metal lamps, spaced 70 yards apart, and he found he was obtaining an illumination equal to that given by modern flame arc lighting. The lamps were on tramway poles and were not affected by vibration; the cost of energy was higher, but the attendance cost less and the burning was more reliable. The fittings were not enclosed in a globe, which appeared unnecessary. He had charged £11 10s. per annum per arc lamp, and was obtaining the same amount for the tungsten groups.

MR. ALEX. CRAMB (Croydon) referred to the solid rows of high-pressure gas lamps which had come into use for outside shop lighting in the London suburbs. The installation was all outside the shops, with a gas main under the pavement, and it was all under the control of the Gas Co., which charged about £5 per 1,000 C.P. lamp per annum and took all responsibility. With electric arc lighting the shopkeeper had the trouble of trimming, &c., and he was naturally glad to be free of it. If the electrical people would offer inclusive terms and take over the maintenance, trimming, &c., from the shopkeeper, the latter would prefer electric lighting, and even pay more for it. The gas people were doing high-pressure shop lighting at cut prices, but if the electric supplier could run outside shop lighting with street lighting, and cut out all intermediate costs, it would be quite possible to compete. He thought powers should be obtained for such work.

MR. A. J. CRIDGE (Electrical Co.) (communicated) said Mr. Haydn Harrison had mentioned combination between the rival illuminating authorities; he (Mr. Cridge) thought they ought to take all straightforward methods of making money, and if reasonable combination was a means to this end, then let them reasonably combine. He wished to emphasise the usefulness of a business-getting department. The value of its missionary work was enormous. The Gas Publicity Committee was new, and he thought that if they had men in the gas industry who made the serious and well-sustained effort which some of the electric supply undertakings did, the gas people would go forward much more rapidly than they did. He advised electrical men to take in a gas paper and read it carefully week by week, as a means of bringing them to a wholesome state of humility.

CONFIDENCE BETWEEN MASTER AND SERVANT.

[BY A LEGAL CONTRIBUTOR.]

IN every business implicit confidence between master and servant is of the first importance. Sometimes the written terms of employment are such that the rights of the master and duties of the servant are set out in express terms, but it is more often the case that there is no written contract, and when trouble arises both parties are at a loss to know what are their exact rights.

It is proposed in the present article to consider the legal principles which are applicable in a case where there is no express contract.

A long series of cases has established that where a relation exists between two parties which involves the performance of certain duties by one of them, and the payment of reward to him by the other, the law will imply, or the jury may infer, a promise by each party to do what is to be done by him. It follows from this that a court of law will look not only to the contract or agreement itself, but to everything which is implied in such a contract.

It is generally understood that if a man undertakes to work for another, he will devote his whole time and energy, not to further his own interests, but for the benefit of his employer. The law will apparently interpret every contract in accordance with this doctrine. But it goes further, and will restrain a servant who has been discharged, or whose term has otherwise come to an end, from taking advantage of information which he may have unlawfully acquired in the time when his whole energies should have been devoted to his employer. It may be of use to refer to one or two cases in which these principles have been recognised. In the case of Robb *v.* Green ((1895) 2 Q.B., I), the defendant, being employed by the plaintiff as manager of his business, secretly copied from his master's order-book a list of the customers, with the intention of using it for the purpose of soliciting orders from them after he had left the plaintiff's service and set up a similar business on his own account. Subsequently, his service with the plaintiff having terminated, he did so use the list. It was decided that it was an implied term of the contract of service that the defendant would not use, to the detriment of the plaintiff, information to which he had access in the course of the service, and therefore that the defendant was liable in damages for any loss caused to the plaintiff by reason of the breach of the term.

It must not be inferred from the decision in this case that a clerk or workman is not allowed to enter into competition with his master after the end of the service. What the law strikes at is the unlawful use of information acquired during the term of service. If there was an implied term in every contract of service that the servant when discharged should not compete with his master, restrictive covenants would be quite unnecessary.

That this is the true state of the law appears from a closer study of the case, for in the course of his judgment Mr. Justice Hawkins said:—"It is good law that a servant having left his master may, unless restrained by contract, lawfully set up in the same line of business as his late master, and in the same locality; and that he may without fear of legal consequences, canvass for the custom of his late master's customers, whose names and addresses he has learned *bona fide* accidentally during the period of his service. . . . But here we are dealing with a flagrant breach of trust during service, with intent to reap the advantage contemplated afterwards. In such a case, too, it seems to me that the fraud in service with intent to use afterwards, and the use afterwards, are both discountenanced by the law. The breach of confidence in service can hardly be said to be a duty of imperfect obligation, for, as I pointed out upon authority, the law will imply a promise to perform it; and the utilisation of the fraud cannot be legalised by the fact that, though that utilisation was contemplated when the fraud was committed, the relation of master and servant had terminated before it was carried out. So to hold would be a great encouragement to fraud. In what I have said I do not intend to convey that while the contract of service exists, a person intending to enter into business for himself may not do anything by way of preparation, provided only that he does not, when serving his master, fraudulently undermine him by breaking the confidence reposed in him. For instance, he may legitimately canvass, issue his circulars, have his place of business in readiness, hire his servants, &c. Each case must depend on its own circumstances."

The principle above laid down seems to apply in every case where the relationship of master and servant has existed, and it was accepted by the Courts long before 1895.

In the case of Lamb *v.* Evans ((1893) I Ch., 218), canvassers who had been employed under agreements which bound them to devote themselves in a particular district, exclusively to obtaining from traders advertisments to be inserted in a directory, and to supply the blocks, and materials necessary for producing such advertisements, proposed at the expiration of their agreements to assist a rival publication in securing similar advertisements. It was decided that they were not entitled to use for the purposes of any other publication, the materials which, while in the plaintiff's employment, they had obtained for the purpose of this particular directory.

There is one other aspect of the question under discussion which is of great interest to manufacturers who find it necessary in the course of business to disclose to mechanics and other persons working for them the nature of, and secrets connected with, inventions for which they may be desirous of obtaining letters patent. The suggestions made by a workman, employed in making a model of an invention for an inventor, cannot be patented by that workman, but, in fact, belong to the employer, and merge in his invention. Hence he is the only person entitled to a patent for them. Therefore, improvements in details suggested by such workman, and embodied in the machine, do not entitle that workman to oppose and stop the master's patent, on the ground that material parts of the invention have been obtained from him. At the same time, inventions devised by a workman while engaged in his master's employment do not necessarily, by virtue of that employment, belong to the master. It is a question of fact in each case. The invention may be so entirely independent of anything suggested to the workman as to be clearly his own invention. In order that employers may secure the benefit of all patents on inventions of those employed by them, it is well to secure the insertion of a definite clause in the agreement.

The following clause is suitable for insertion in an agreement with a tramway manager:—"Any invention or patent either connected with tramways or otherwise invented or acquired by the manager during the continuance of his employment by the company, shall be his sole property; but the company shall have free licence without payment of any royalty to the manager to use the same either during the continuance of the employment of the manager hereunder, or at any time thereafter, provided always that no such patent shall be used by the company until a resolution of the board of directors to that effect has been passed, and a copy of the said resolution sent to the manager, addressed at his last known place of abode or business."

It would seem to follow from what has been said that if a workman, after the termination of his period of service, were to take out a patent for some article which he had virtually invented during the period of employment, his title might be unassailable, but if it were shown that he, in fact, robbed his master of an invention, and forestalled him in taking out a patent for it, the Court would, in all probability, interfere.

Hitherto we have dealt with cases in which the duty not to avail himself of his master's secrets had not been expressly laid down in the contract. Where there is an express term, but little difficulty arises.

In a case which was heard in the High Court in 1904 (Barr *v.* Craven) an action was brought by an insurance company against four discharged agents and another insurance company, alleging that the agents had made use of the knowledge which they had obtained while they were in the employment of the plaintiff society for the purpose of inducing persons, who were policy-holders in the plaintiff society, to transfer their policies to the defendant society. Each of these agents had signed contracts which contained clauses to the following effect: "(7) To deliver up in case of my resigning the agency, or being dismissed therefrom, all name-plates, show-cards, books, papers or other property belonging to the society, or in any way relating to the business of the society, to

my superintendent or any other officer of the society, as directed by the general manager for the time being of the society, or by my said superintendent; (8) to introduce all the members in my agency to my successor or to any officer of the society, and not to interfere directly or indirectly with any of the business, after having resigned this agency, or being dismissed therefrom."

It was urged on behalf of the defendants that this covenant was too wide, and therefore void, as being against public policy. It was limited by neither space nor time, and it applied to the whole business of the plaintiff society, wherever carried on. The Court granted an injunction. Lord Justice Matthew said: "In my view upon the true construction of these contracts, the 'business' meant the 'business of my agency,' and the restriction is confined in each case to the locality in which the particular defendant was agent to the plaintiff society. There can be no objection to such a contract, and it is right to restrain a breach." This was a case of restraining the discharged servant from canvassing customers. A similar injunction would, doubtless, be granted if the servant were under covenant not to disclose the information which he might acquire during his term of employment.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,398. "Brakes for steam and electric travelling cranes." F. H. M. THOMAS. July 3rd.

15,431. "Electric railway signalling systems." M. L. HEIN and J. COPP. July 3rd. (Complete.)

15,447. "Method of using electric batteries for supplying lamps." CHEMISCHE FABRIK GREISHEIM-ELEKTRON. (Convention date, August 2nd, 1910, Germany.) July 3rd. (Complete.)

15,453. "Secondary storage batteries or electrical accumulators." O. OLDHAM. July 3rd.

15,469. "Safety device for controllers for electric motors." J. WOODFORD. July 3rd. (Complete.)

15,474. "Electric arc lights." GENERAL COMPOSING CO. GES. M.B.H., (Convention date, July 4th, 1910, Germany.) July 3rd. (Complete.)

15,502. "Circuits for telephone instruments." BRITISH INSULATED AND HELSBY CABLES, LTD., and J. B. REDFERN. July 4th.

15,503. "Telephone exchange systems." W. AITKEN and BRITISH INSULATED AND HELSBY CABLES, LTD. July 4th.

15,508. "Switches for controlling the electric lighting systems of automobiles." J. B. BROOKS and W. HOLT. July 4th.

15,512. "Carriers for electric lamp shades, globes, reflectors, galleries, or the like." G. ST. J. DAY. July 4th.

15,513. "Electrical signalling device." T. WEISS. July 4th, (Complete.)

15,524. "Electrical headway clock." H. B. SWIFT and W. D. BAXTER. July 4th.

15,531. "Dynamo-electric generators." G. INRIG and L. INRIG. July 4th.

15,544. "Method of manufacturing metallic filaments or bands to be used particularly in connection with thermic telephones." B. GWOZDZ. July 4th. (Complete.)

15,550. "Means for fixing electric fans and the like apparatus." A. H. RAILING and A. J. D. KRAUSE. July 4th.

15,551. "Measuring the output of Röntgen rays from an X-ray tube and regulating the dosage for skin treatment and the like." R. S. WRIGHT. July 4th.

15,559. "Printing telegraphy." C. KINGSLEY. July 4th. (Complete.)

15,564. "Portable electric fuse wire-carrier." F. CHASE. July 4th.

15,569. "Subscribers' sender mechanism for automatic telephone systems." TELEPHON APPARAT FABRIK E. ZWIETUSCH CO. G.m.b.H. (Convention date, July 5th, 1910, Germany.) July 4th. (Complete.)

15,585. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD., E. B. WEDMORE, J. M. WALLACE and W. P. HAMLYN. July 4th.

15,597. "Auxiliary apparatus for electric traction." W. D. B. DUDDELL and G. W. PARTRIDGE. July 5th.

15,599. "Electric lampholders." R. CRUST. July 5th.

15,607. "Device for starting, controlling and protecting electric motors." WOLSELEY SHEEP SHEARING MACHINE CO., LTD., and A. E. BREWERTON. July 5th.

15,646. "Electric safety fuses." M. KALLMANN. (Divided application on No. 16,258/10, July 7th.) July 5th. (Complete.)

15,684. "Clock having electrical winding mechanism." A. F. GERDES. July 5th. (Complete.)

15,690. "Electrically-actuated sewing machines." A. REBSAMEN. (Convention date, July 6th, 1910, Switzerland.) July 5th. (Complete.)

15,695. "Dynamometers." HENNAN & FROUDE, LTD., and F. HARRISON. July 6th.

15,719. "Electric incandescent lampholder cap." F. C. MAYES. July 6th.

15,725. "Telephones." C. F. KILLAR. July 6th.

15,730. "Electric arc lamps." GES. FUR MACHINEN UND METAL INDUSTRIE m.b.H. (Convention date, July 6th, 1910, Germany.) July 6th. (Complete.)

15,751. "Electric conductors.." J. HARDEN. July 6th.

15,794. "Electric arc lamps for cinematograph projection and the like." A. COLE and F. WILSON. July 7th.

15,798. "Current distributors for power looms having electrical stopping and signalling devices." E. C. R. MARKS. (Spinnerei & Weberei Steinen Akt. Ges., Germany.) July 7th. (Complete.)

15,804. "Electric alarm." W. H. BOORNE. July 7th.

15,841. "Electric motor control systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 7th.

15,845. "Dynamometers." W. G. WALKER. July 8th.

15,859. "Attachments in telephone mouthpieces." A. E. BRADSHAW. July 8th.

15,862. "Clutch mechanism for the detachable attachment of an arc lamp or other appliance to a post or high-up support or suspender." F. S. WORSLEY. July 8th. (Complete.)

15,866. "Electrical conduit junction boxes and the like." T. G. GATIS (trading as Graiseley Foundry Co.). July 8th.

15,889. "Electric heating and cooking devices." FERRANTI, LTD., and M. B. FIELD. July 8th.

15,894. "Telegraphy and telegraphic apparatus." J. S. ENRIGHT and A. S. PLEWS. July 8th.

15,898. "Means for automatically controlling heat in electric heating apparatus." V. NIGHTINGALE. July 8th. (Complete.)

15,899. "Apparatus for electric cooking and heating." V. NIGHTINGALE. July 8th. (Complete.)

15,901. "Systems of electric motor control." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

METALLIC FILAMENT ELECTRIC LAMPS. Westinghouse Metallfaden Gluhlampenfabrik. Ges. 22,852. October 3rd. (October 6th, 1909.)

AUTOMATIC TELEPHONE SYSTEMS. E. Neuhold. 22,959. October 4th. (September 3rd, 1910.)

ELECTRIC INCANDESCENT LAMP CAP. F. C. Mayes. 24,216. October 19th.

INCLINABLE ELECTRIC LAMP SUPPORTS. J. Neple. 24,818. October 25th. (October 26th, 1909.)

TELEPHONE SWITCH BOARDS. W. Aitken and British Insulated and Helsby Cables, Ltd. 25,502. November 3rd.

AUTOMATIC TELEPHONE CIRCUITS. Siemens & Halske Akt.-Ges. 27,026. November 21st. (November 20th, 1909.)

FIRE ALARMS. J. H. Bruhn. 28,135. December 3rd.

MERCURY CONTACT ELECTRIC SWITCHES. Dr. Paul Meyer Akt.-Ges. & Kohnel. 28,657. December 9th.

APPARATUS FOR ELECTRICALLY CONTROLLING MECHANISM AT A DISTANCE. C. G. Lohay. 29,378. December 17th. (Addition to 14,431 of 1908.)

ELECTRIC ARC LAMPS. R. Schmidt. 29,506. December 19th. (December 20th, 1909.)

INCANDESCENT LAMP REGULATOR. R. Smith and Kaatz. 29,700. December 19th.

ELECTRO-MAGNETIC APPARATUS APPLICABLE TO STAMPS, CRUSHING MACHINERY AND THE LIKE. Franz Meguin & Co. 6,212. March 12th. (March 12th, 1909.)

ELECTROLYSIS OF LIQUIDS. J. Billiter. 11,693. May 11th. (Convention date not granted.)

APPARATUS FOR ACTUATING BELLS AND FOR OTHER PURPOSES. N. K. Harris. 12,047. May 14th.

ELECTRIC INSULATING MATERIAL. British Thomson-Houston Co. (General Electric Co.) 13,946. June 8th.

TERMINALS OR CONNECTORS FOR WIRES, CABLES OR THE LIKE. C. N. Staniland. 14,045. June 10th.

EARTHING DEVICES FOR CONDUCTORS AND OTHER ELECTRIC APPARATUS. R. Lomax. 14,057. June 10th.

CIRCUITS FOR AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,196. June 11th.

ELECTRICALLY-ILLUMINATED LETTER SIGNS AND THE LIKE DEVICES. H. Hirst and G. Maurice. 14,349. June 14th.

ELECTRIC ALARM SYSTEMS. F. Castle, E. J. Riddiford, W. E. Bidwill and L. L. McDermott. 14,383. June 14th.

ELECTRICAL MACHINES. W. A. Price. 14,499. June 15th.

DYNAMO-ELECTRIC MACHINERY. H. C. P. Parsons and A. H. Law. 14,680. June 17th.

ELECTRIC RESISTANCES FOR ELECTRIC HEATING AND OTHER APPARATUS. F. E. Wilkinson. 14,912. June 21st.

CONTROLLERS FOR ELECTRIC MOTORS. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 14,916. June 21st.

CONTROLLERS FOR ELECTRIC MOTORS. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 14,956. June 21st.

ALTERNATING-CURRENT ELECTRIC METERS. G. North. 15,170. June 23rd.

INCANDESCENT ELECTRIC LAMPHOLDERS. H. Specht and O. Beige. 19,033. August 12th. (August 12th, 1909.)

MANUFACTURE OF DETACHABLE ELECTROLYTIC IRON DEPOSITS. Marks (Langbein-Pfanhauser-Werke Akt.-Ges.) 25,092. October 2:th.

ENCLOSED ELECTRIC SWITCHES. V. Hope. 25,923. November 8th.

REVOLVING ELECTRICAL FURNACES. O. Serpek. 29,299. December 16th. (August 11th, 1910.)

1911.

ARC LAMPS. H. E. Moul. (Korting.) 741. January 11th.

ELECTRIC FURNACE FOR TREATING GASES. H. Pauling. 3,251. February 8th.

SUPPORTS FOR ELECTRIC CONDUCTORS OR RAILLESS-TRACK SYSTEMS. H. Sefton-Jones (Oesterreichische Daimler Motoren Ges.). 3,747. November 29th. (Divided Application on 27,798/1910. November 29th.)

PROCESS AND APPARATUS FOR ELECTROLYTICALLY MEASURING ELECTRICITY. Schott and Gen. 10,792. May 4th. (May 23rd, 1910.)

MEANS FOR MECHANICALLY OPERATING RAILWAY AND TRAMWAY POINTS FROM THE VEHICLES. G. Campana. 1,020. January 14th. (January 14th, 1910.)

ELECTRICITY METERS. H. Landis and K. H. Gyr. 1,056. January 14th.

ELECTRIC SWITCHES. Siemens Bros. Dynamo Works, Ltd., and Bolton. 2,504. February 1st.

SEPARATORS FOR SECONDARY BATTERIES. F. W. Hardy and H. Hungerbuhler. 7,086. March 21st.